Gas Journal

VOL. 287. 108th YEAR. LONDON, JULY 4, 1956. Nº 4851. PRICE 1/6

TECHNOLOGY DEPT.

GAS COMPRESSORS
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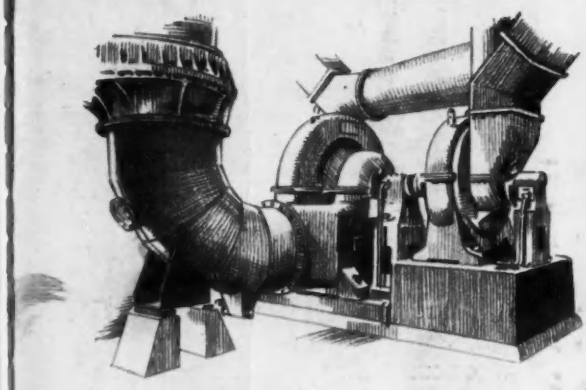

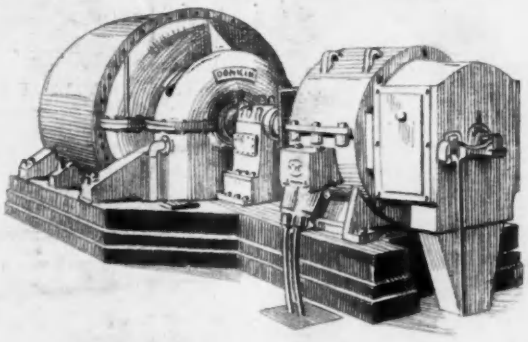

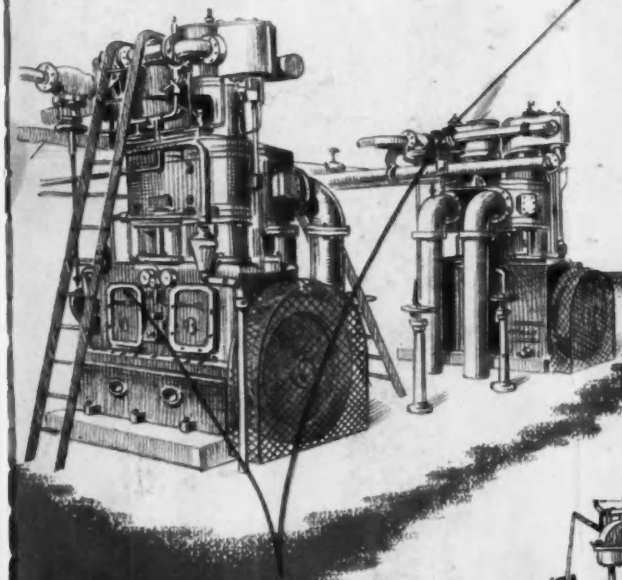

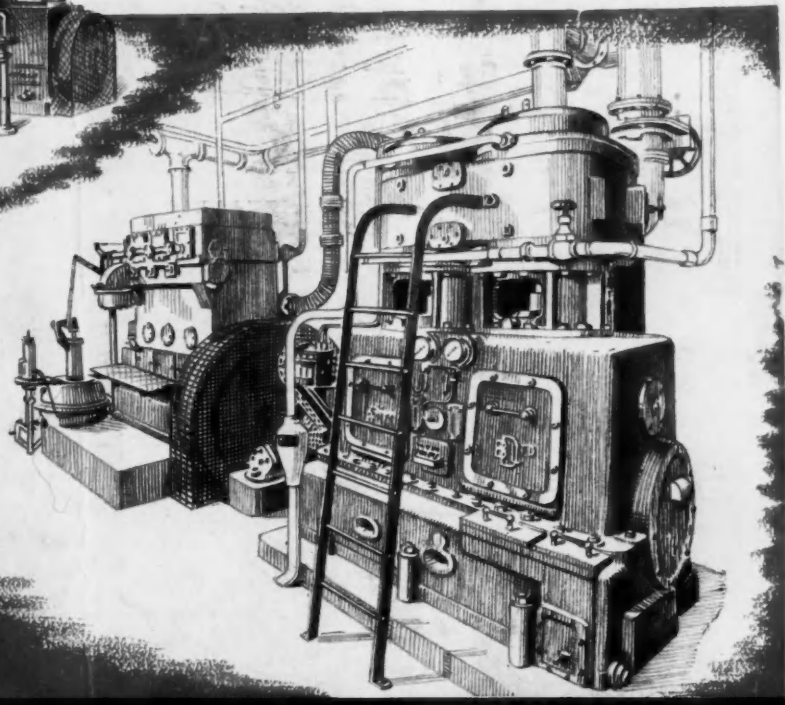

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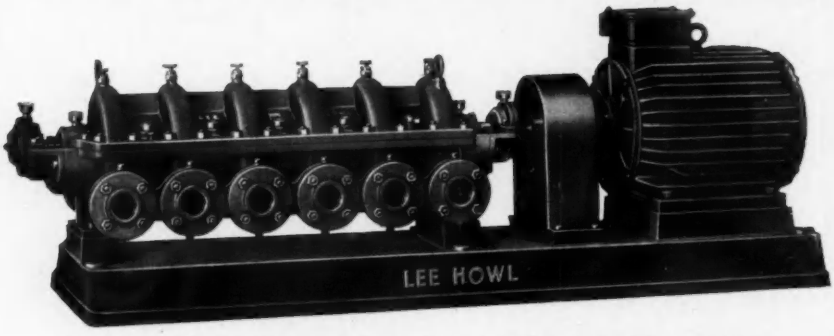

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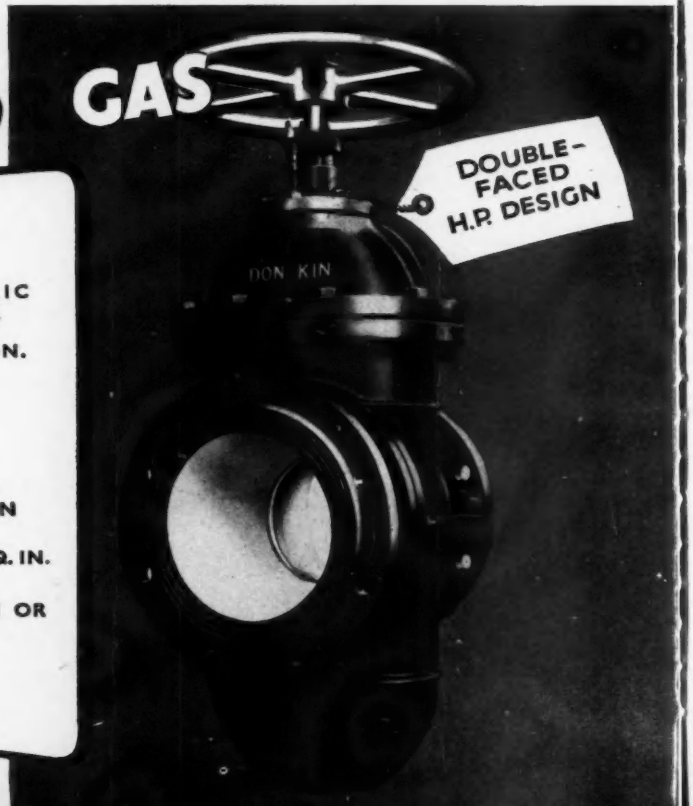

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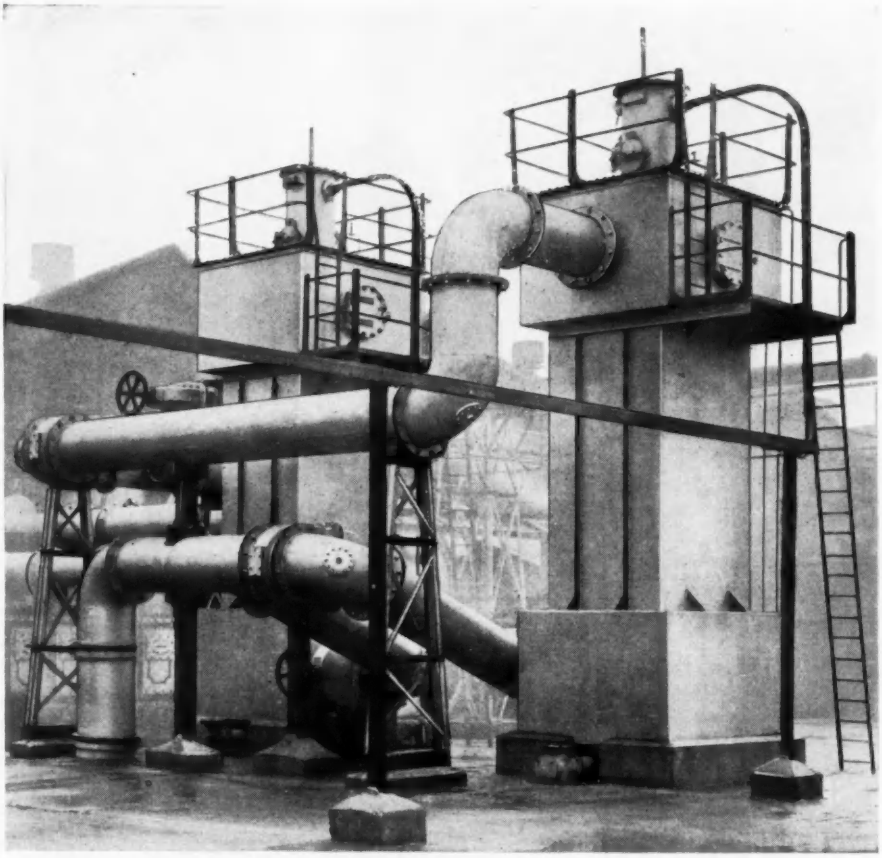

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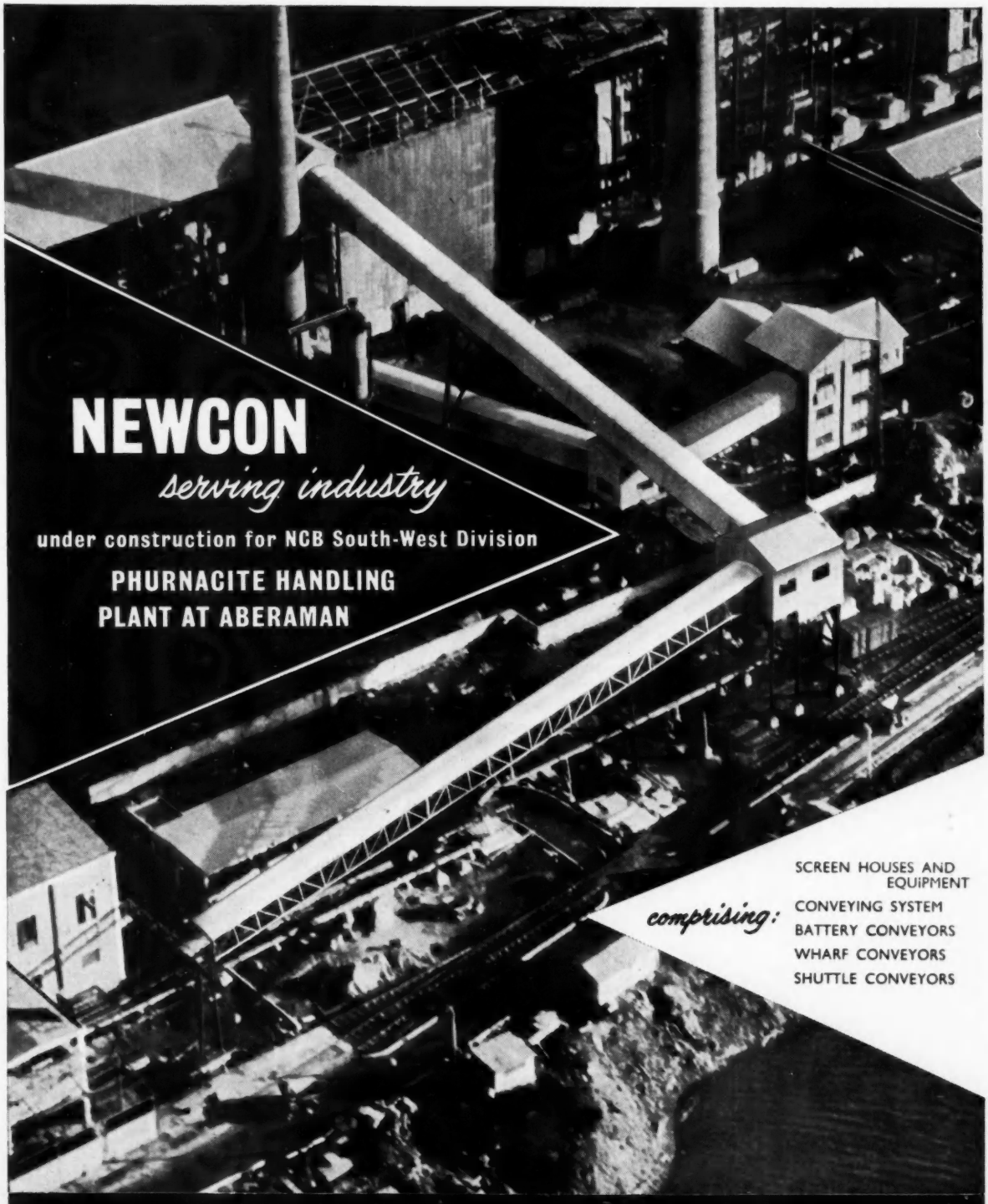

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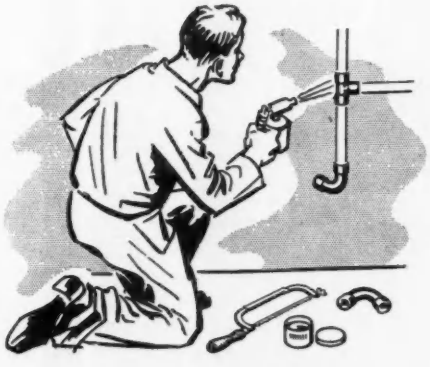

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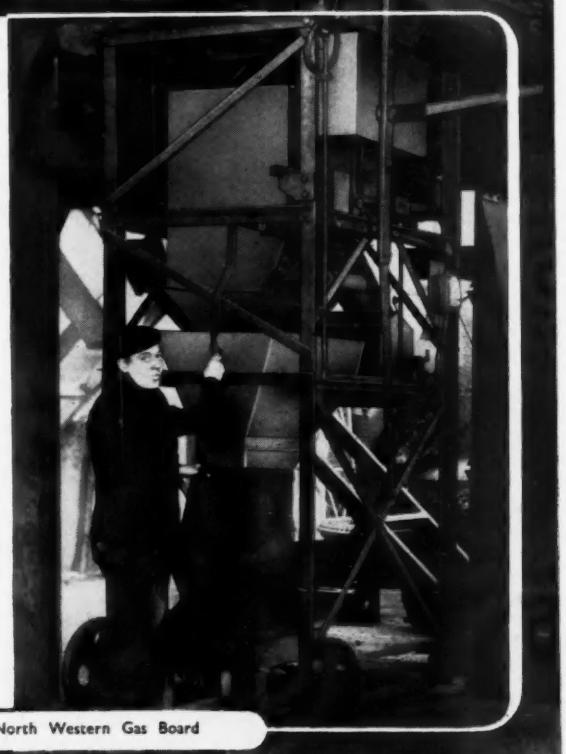

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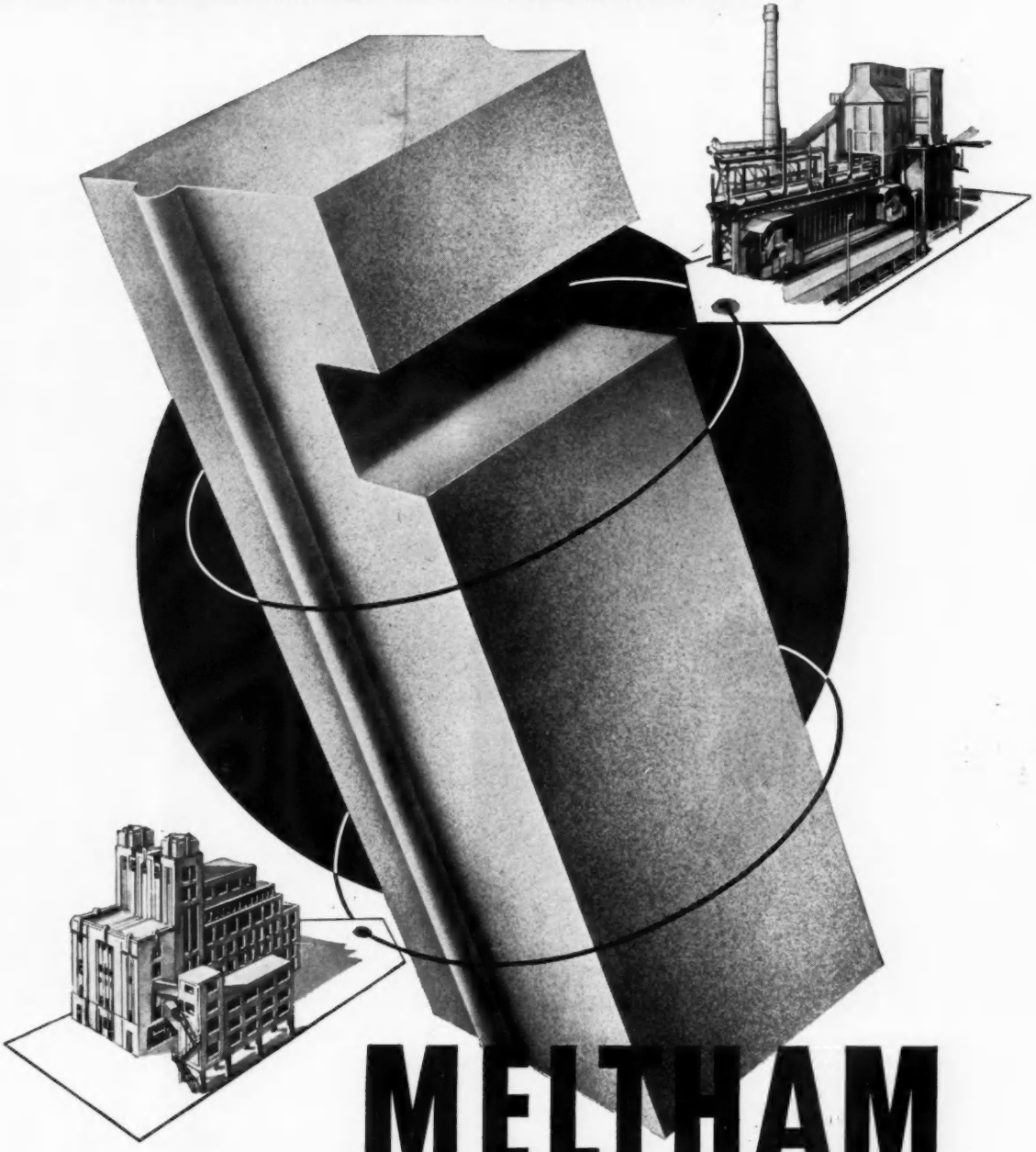

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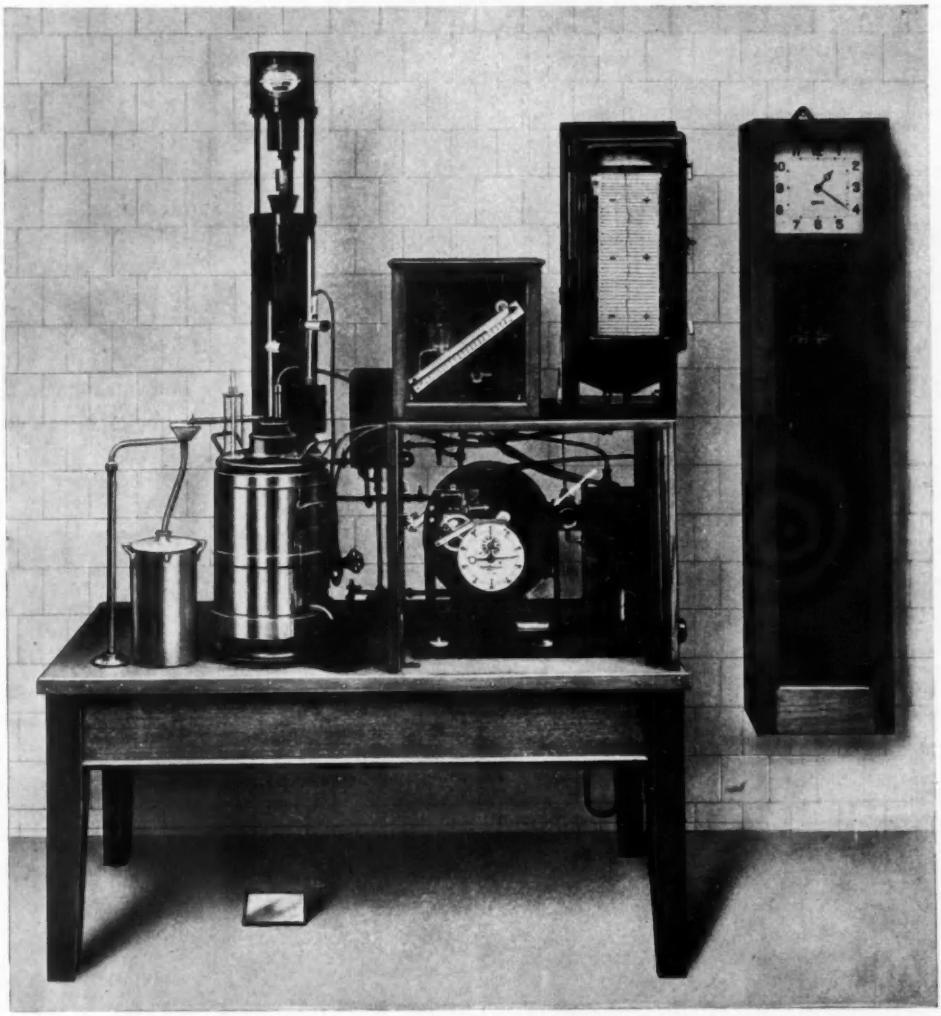

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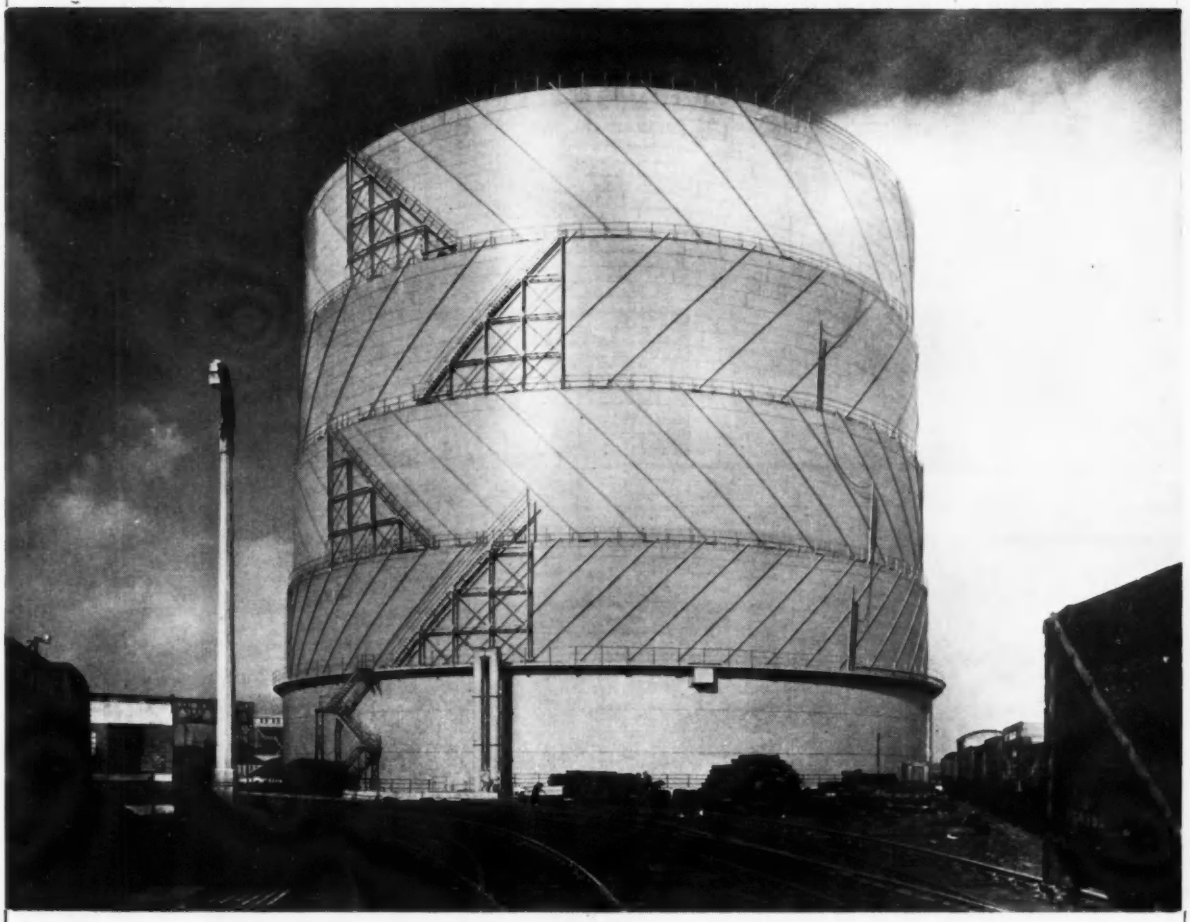

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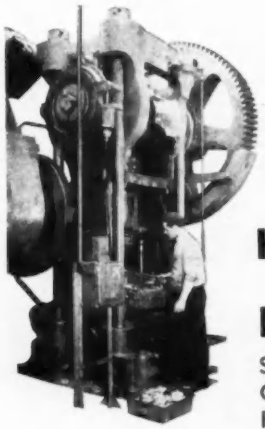

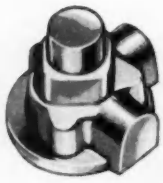

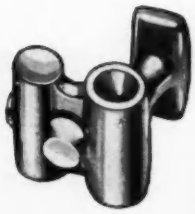

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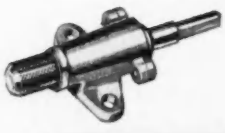

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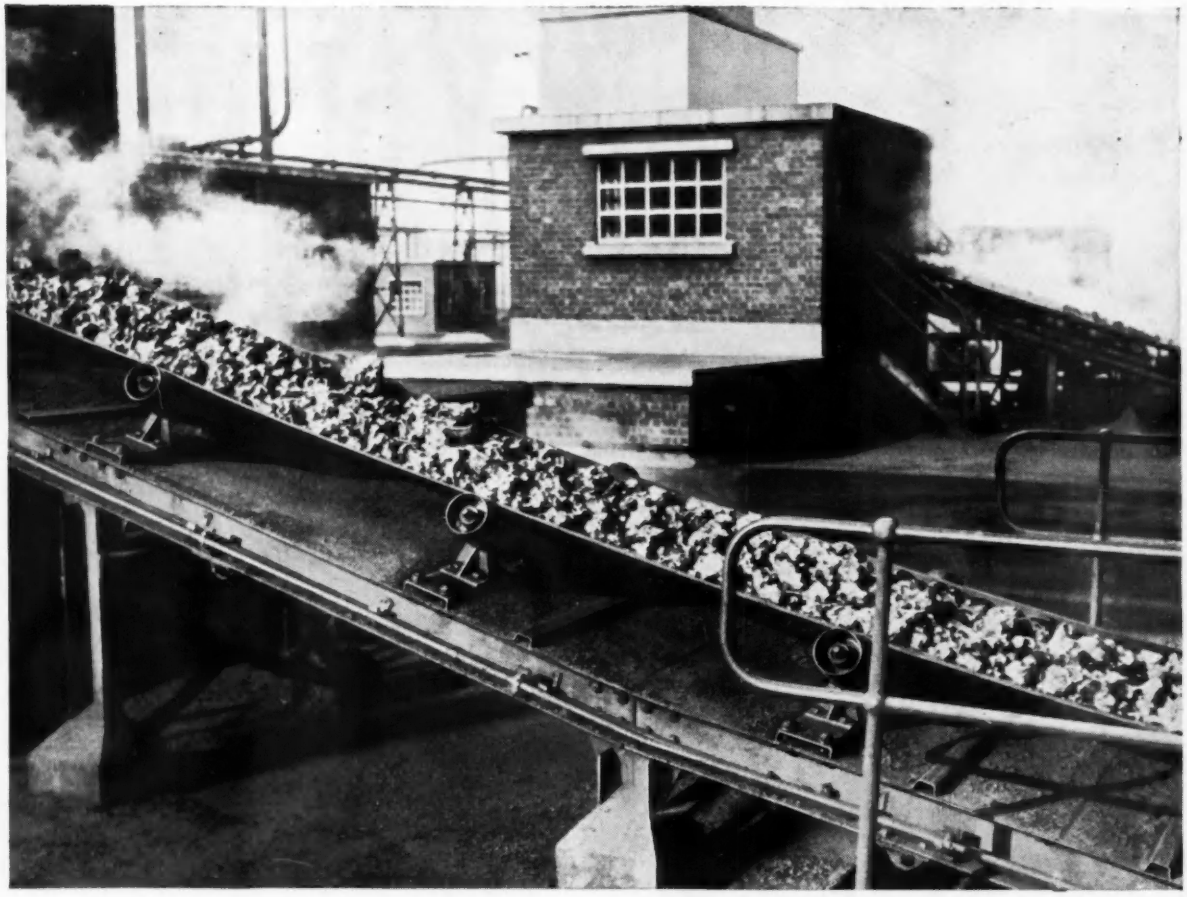

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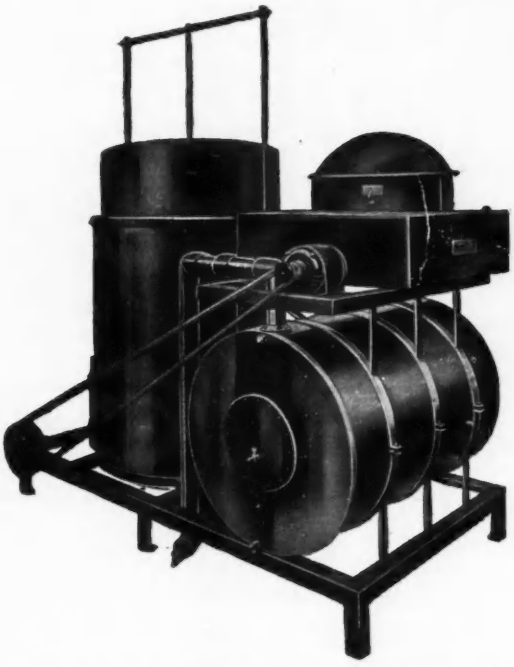

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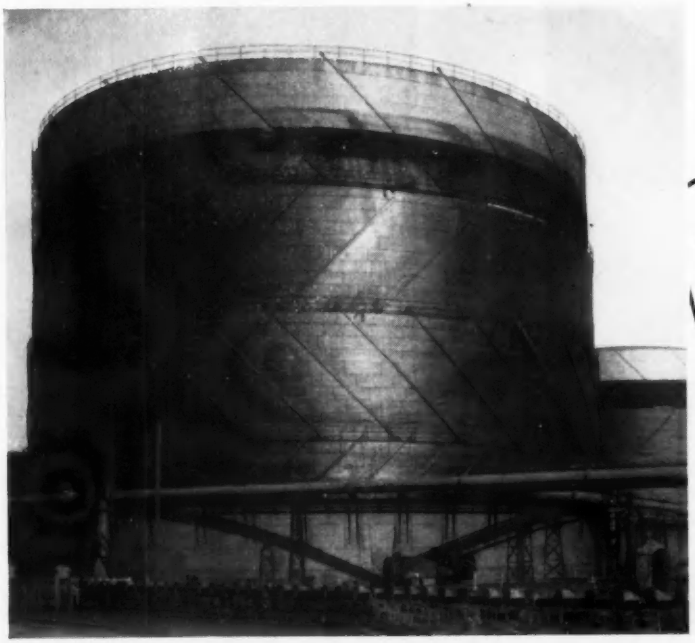

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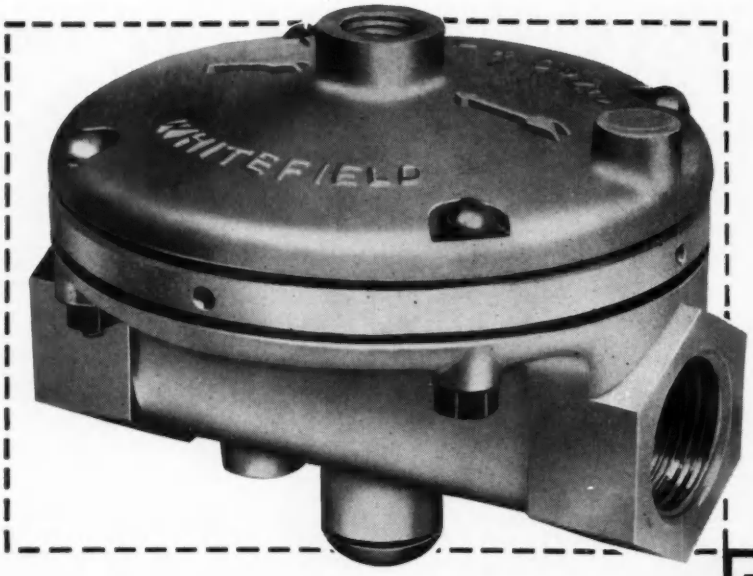

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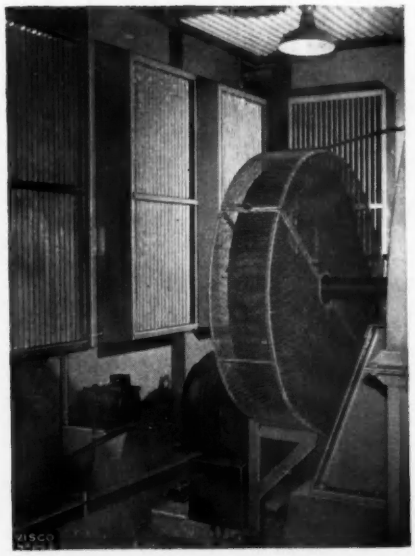

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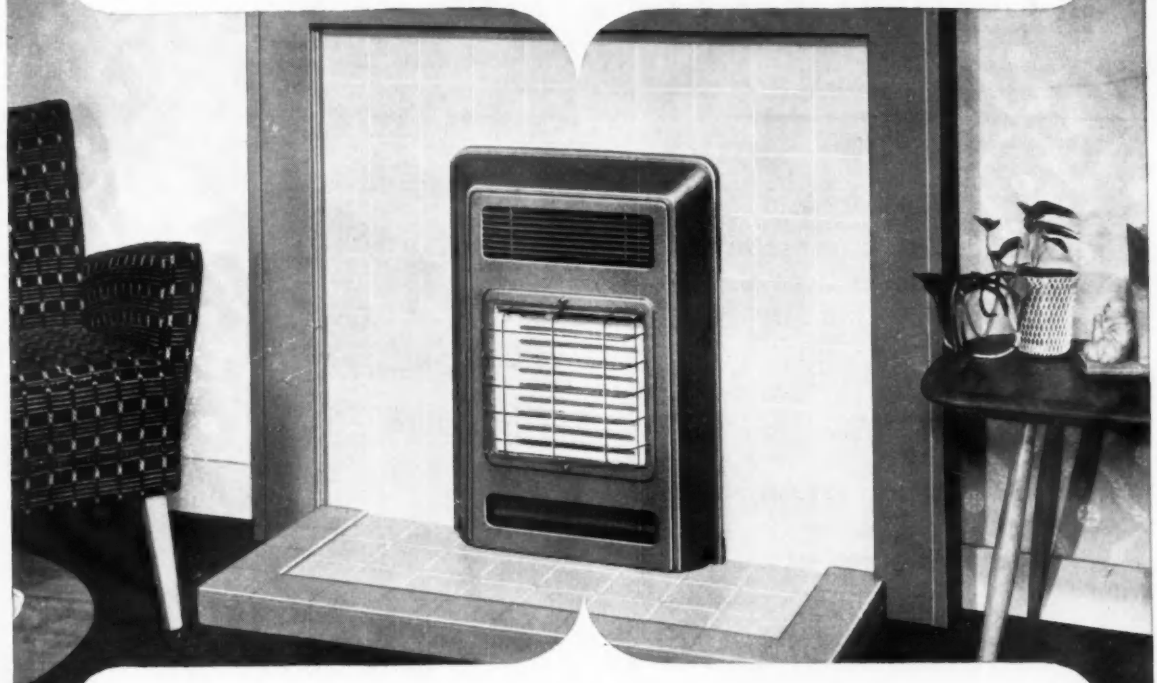

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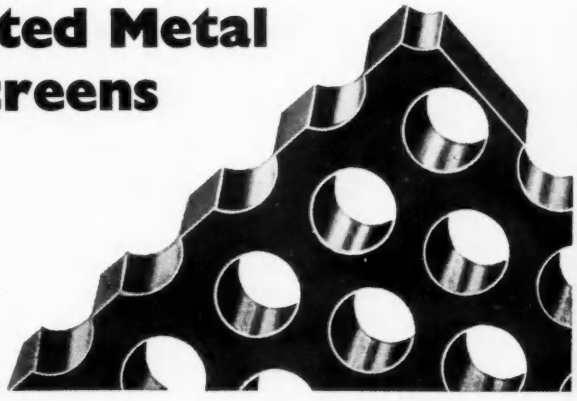

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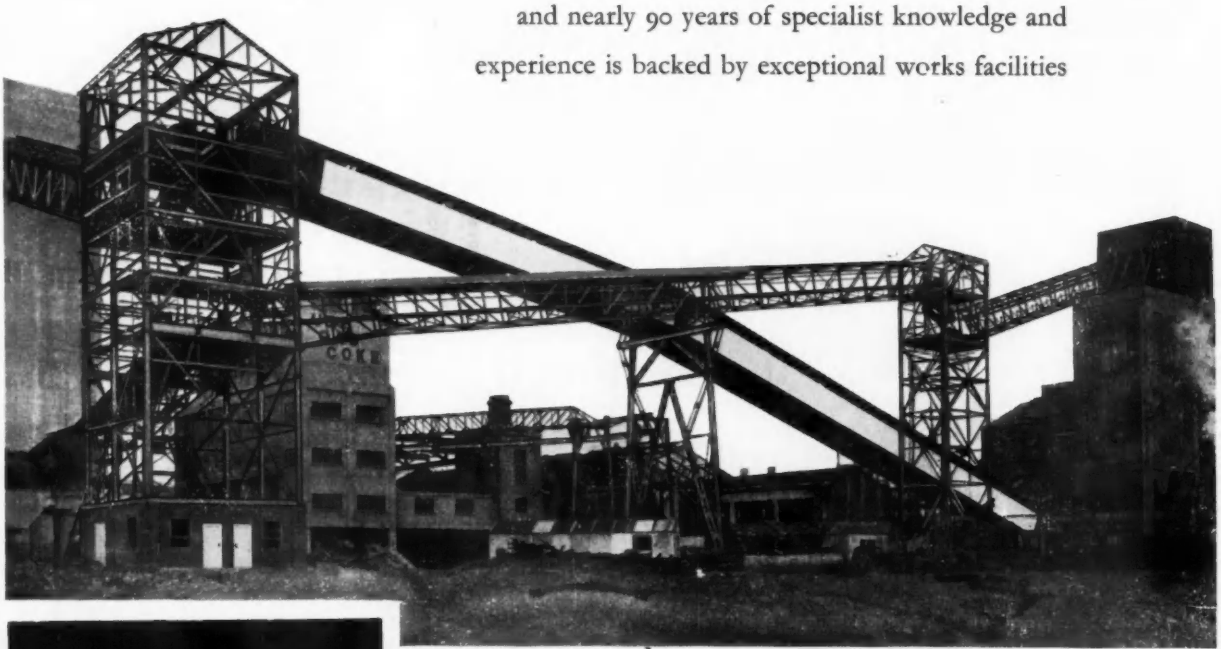

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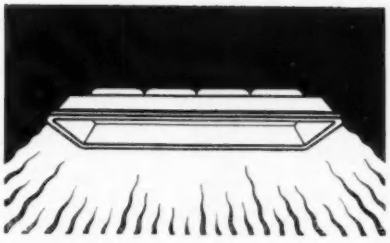

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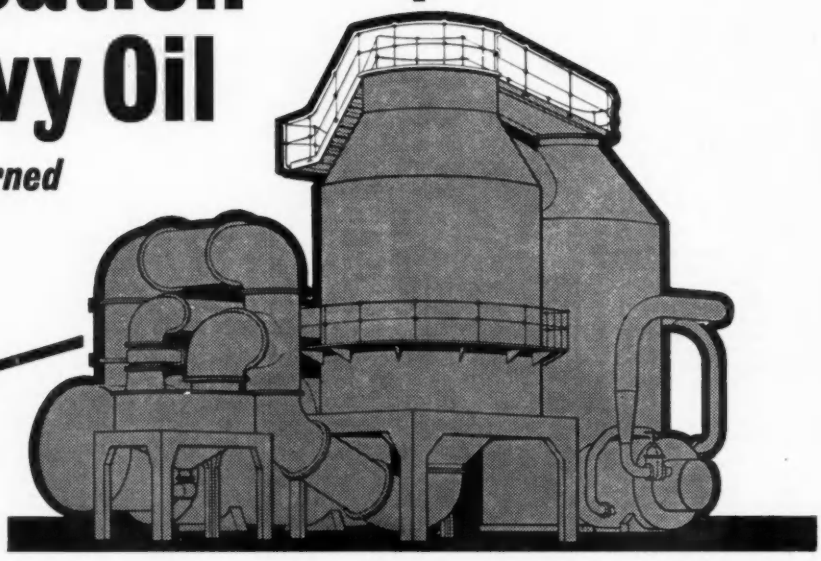

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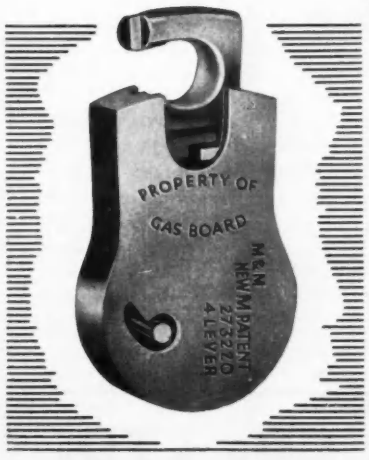

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Gas Journal

VOL. 287 NO. 4851 July 4, 1956

108TH YEAR

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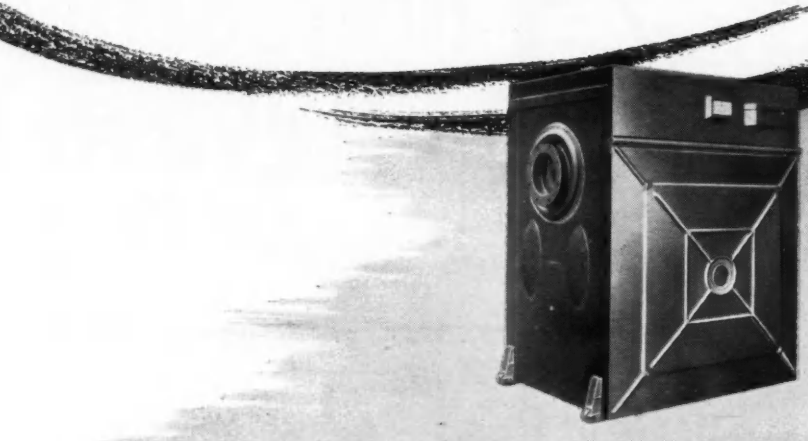

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Gas Journal

VOLUME 287. No. 4851. JULY 4, 1956. 108th YEAR

Safety First

THE importance of the safety of men and women employed in factories or by a gas undertaking (a gasworks is a factory in the meaning of the Factory Acts) was once more emphasized by Mr. H. G. Hall, Chief Safety Officer of the North Western Gas Board in a paper read before the North Western Gas Board's Joint Consultative Council Conference at Blackpool last April. The whole business of taking all the necessary measures that men working in a gasworks should have the benefit of all possible safety devices and the full protection of the Factory Acts is of course the ultimate responsibility of the station engineer, as he is looked upon as the 'occupier' of the factory or workshop, being the senior officer on the spot.

Since the nationalisation of the gas industry in May, 1949, the whole structure of the industry has changed from a heterogeneous mixture of a few large units and a large number of small units, the great majority of which were completely independent. During the pre-nationalisation era the safety arrangements of the large units were almost certainly properly organized, and every precaution was taken to make certain that the standard of safety was high and the provisions of the Factory Acts faithfully adhered to. With the smaller undertakings, the safety arrangements must necessarily have been much more left to chance, and perhaps the most important influence in enforcing safety precautions in the smaller works was the all too infrequent (perhaps too frequent in many peoples' opinion) visits of the factory inspector, the alkali inspector, or the representatives of the local river board. These visits would keep the engineer and manager on his toes to see that obvious precautions had been taken and that not too glaring a breach of the Acts was apparent. The factory inspectors are a most understanding body of men and were always willing to respond in cases where there was real co-operation in face of rising costs of providing the precautions asked for.

With nationalisation, however, the scene changed. The whole question of safety at work and the enforcement of the Factory Acts became a matter of area board policy and could be centrally administered. To do this satisfactorily, safety officers were appointed. A chief safety officer would have his office at board headquarters and be in the position of receiving instructions in accordance with Board policy and also be able to handle queries from the safety officers on the works. The big London undertakings, such as the Metropolitan Divisions of the North Thames Gas Board, have a safety officer at each works and two at Beckton, because of its large area and vast output of gas. At each of these works the safety officer is directly responsible to the station engineer, as he is the 'occupier,' but should he fail to get response or co-operation from the station engineer, the safety officer can go over his head and appeal direct to the Chief Safety Officer at Board Headquarters. As the Chief Safety Officer, in this particular case, has the status of a station engineer, he can discuss the matter among his equals, but if he is still unsuccessful, he can take the matter up with the Chief Engineer in whose department he is.

In the other area boards, the administrative arrangements must necessarily be somewhat different. In Mr. Hall's own Board, the North Western, where there is no single works as big as the London metropolitan stations, the Board's area is divided up into groups, each of which is autonomous in its methods of interpreting its Board's policy. In each group there is at least one safety officer (two in the Manchester Group, which is the largest in gas output). These officers, though in close touch with the production department of their group and also with the Chief Safety Officer, are ultimately responsible to their group general manager, who will in turn be responsible to the Board.

One of the first things the chief safety officer had to do was to organize an efficient accident reporting system. Before nationalisation, this was probably already in existence, but in the smaller undertakings it was less well provided for, though of course fatal accidents must needs be reported to the police and the factory inspector, whoever may have owned the undertaking.

The accident statistics compiled since nationalisation are, therefore, very much more reliable than anything before, so that comparisons may not be quite fair; even so, they do not make very pleasant reading. Quoting from a recent annual report of the Chief Inspector of Factories, there appear to have been in 1939 15 fatal and 1,955 non-fatal accidents in the gas industry, but in 1954 the corresponding figures were 17 and 3,419. This may have been due to better reporting, but two additional deaths are serious.

Mr. Hall stresses the need for the extra precautions, and gives two formulæ for making comparisons, namely, the 'frequency rate,' and the 'mean duration rate.' After a rise in 1955, the frequency rate in the North Western area shows signs of falling again, but the mean duration rate, *i.e.*, the total number of hours lost per number of time lost accidents, seems to be showing a tendency to increase.

Mr. Hall's remedy for these tendencies is to educate every man to become safety conscious, to help him to think and act in the safe way, to take no risks, to uproot completely the idea of getting away with it and not bothering to use the safety devices provided, to back up the foremen and charge hands and to encourage them in the use of safety devices, and perhaps the most important of all, to encourage and even to insist on the manufacturers incorporating the most modern—and therefore generally the safest—designs in all future plant.

Domestic Coke Preparation

THE immediate problem before the gas industry is to fill the gap in the supplies of smokeless solid fuel required to implement the Clean Air Policy —and to do this without burdening the cost of gas with too much of the cost of preparing coke for the domestic market. We have to sell the idea of replacing coal by gas coke to a public deeply prejudiced against it. To do this we must succeed as far as possible in providing a regular delivery of properly graded coke, free from dust, as free as possible from breeze, with the correct moisture content, and above all, of consistency in all these properties. All this has been said many times before. The paper presented by Messrs. Roberts and Rodick at the Institution Meeting, describing their practice at Kensal Green (I.G.E. Communication 489, published in our June 6 issue, p. 774) is therefore of the utmost interest and importance. As Mr. F. G. Pyper summed it up, it is 'an excellent contribution to knowledge.'

The discussion is highly constructive and should be read with the paper. Indeed, Mr. J. A. Hepworth's contribution may also be taken as an effective summary of the paper and the conclusions established in it. Some engineers will continue to deplore the use of even 'closely controlled water injection' into the coke-receiving hoppers below the retorts, because if dust extraction is effectively applied to the discharge from these hoppers with the coke still dry, a peculiarly fine powder, almost molecular in size, is removed, and once removed does not re-appear in subsequent handling. It is this fine dust, it is contended, which gives rise to that peculiar offensive 'smell' in the domestic coke bin which gives so much annoyance to the consumer.

With the many observations on and recommendations regarding coke handling plant there is evidently general agreement. The suitably lined spiral chute remains the most effective means of reducing breakage in large bunkers. It has been applied to large heaps on the ground under stocking band conveyors. It is generally agreed that the band conveyor itself handles coke with the minimum of breakage. There remains however the breakage at the point of transfer from one conveyor to another, and of course 'the great disadvantage of the low angle at which the conveyor can work,' minimized to some extent by the recently mentioned 'blanket conveyor' of which we may hear more.

The authors estimate that coke from CVR 'degrades to breeze to the extent of about 0.5% each time it suffers a moderate impact.' The seriousness of this degradation is emphasized in the monetary loss which may amount to £28 per 100 tons of 'potential yield of saleable coke.' There is dust too at these points of transfer, and attempts have been made to apply suction dust extraction at these points. In spite of the heavy wear and tear on the gravity bucket conveyor when handling coke it appears to be the best appliance when it is necessary to lift coke continuously in a restricted ground space.

But the novel feature of the paper is the apparatus described for the dry cleaning of coke. The description of the pneumatic shale separators will be studied carefully. Nothing is so troublesome as the presence of shale in an otherwise well-prepared coke, and all will hope that the further work suggested by Mr. Hepworth will be undertaken 'to establish improved techniques and designs of plant' directed to the removal of shale and bats.

The differences of opinion on the question of the regrettably necessary stocking of coke were well brought out. Should it be stocked screened or as 'run-of-retort' coke? Can we expect the consumer to assist by stocking coke himself during the summer months? Lack of space militates against a favourable reply to the second question, but there will be general agreement with the suggestion that 'some form of preferential summer tariff should be considered in order to encourage' the consumer to make room for it.

Mr. F. A. Burden analyzed the effect of improvements in coke preparation on complaints and, returning to our first point, we note Dr. A. E. Haffner's remark 'that with the increasing tendency' (we should say 'necessity') to expect coke to take up a major share of the increased cost of coal, coke prices have reached a level where the customer was certainly entitled to expect a high-quality product.'

The Government and the Nationalised Industries

Extract from a speech by Mr. Aubrey Jones, Minister of Fuel and Power, at Halesown, Worcs., June 30.

'It is tempting to say that the efficiency of the nationalised industries will be improved by tightening the political grip on them, by piling on ministerial and parliamentary control. As a matter of fact, no number of watch dogs from outside, no amount of extra government or parliamentary control can ever remedy inefficiency in a nationalised industry, or be a substitute for efficient leadership in the industry itself.

'The way to make a nationalised industry efficient is to put in its charge men who are prepared to display initiative. But no one will ever display initiative if he is constantly subjected to ministerial interference. No one will ever have any sense of responsibility if he knows that a Minister is always liable to undermine it. We Conservatives preach de-centralization. We cannot have both de-centralization and a tighter government grip. We are a Party which believes in business methods. We cannot have both businesslike nationalised industries and make government departments of them. Let us concentrate on making the nationalised industries fields in which it is attractive for men of talent and character to operate; but let us also realize that all talk of closer political control is in contradiction to this end.'

Personal Notes

MR. W. T. COOPER, who has been Editor of the *Journal* and other publications of the Institute of Fuel since 1948, is resigning at the end of July to take an appointment as Senior Research Officer, Australian Commonwealth Scientific and Industrial Research Organization. Mr. Cooper will be in charge of information and public relations work in the coal research section of C.S.I.R.O. at North Ryde, Sydney, N.S.W. He is to succeed Mr. N. Y. Kirov as Honorary Secretary of the Australian membership of The Institute of Fuel in January, 1957.

MR. E. L. MATHERS has been appointed Sales Manager of General Gas Appliances, Ltd. Mr. Mathers began his career in the gas industry with Ascot Water Heaters Ltd., joined General Gas Appliances Ltd., in 1953 and was appointed Southern Sales Manager in January, 1955.

MR. FRANCIS D. DRAKE, a Director of Drakes (Engineers) Ltd., Ovenden, Halifax, has been appointed Vice-Chairman of the Ironfounders National Confederation. Mr. Drake is President of the East and West Ridings Branch of the I.N.C.

Obituary

MR. JAMES WHITFORD ATKINSON, Engineer and Manager of the Wanganui City Council Gas Department, has died aged 47 years. Mr. Atkinson represented the third generation of an outstanding gas engineering family which has long been associated with the gas industry in New Zealand; he was a past President of the New Zealand Gas Institute. He is survived by his wife, three sons, and one daughter.

Calendar & Directory

Alterations

The following changes have been notified during the past month. To keep the information in the current 1956 edition of the Gas Journal Calendar and Directory up to date readers are invited to note these alterations in the Directory Section.

Page D66.—LIVERPOOL GROUP: R. H. Naylor, *Distribution E.*, vice F. Bell.

Page D133.—COLERAINE: Delete W. R. Armstrong, *M. and E.*, deceased.

Diary

July 3-6.—BRITISH WOOD PRESERVING ASSOCIATION: Annual Convention, Cambridge.

July 6.—MIDLAND I.G.E.: Summer Meeting and Ladies' Day, Leicester.

July 9-14.—SOCIETY OF CHEMICAL INDUSTRY: 75th Annual Meeting, London.

July 16.—EASTERN G.C.C. 2 p.m.

July 23.—WEST MIDLANDS G.C.C.—Birmingham Education Department, Council House, Margaret Street, Birmingham, 3.

July 26.—NORTH THAMES G.C.C.: Caxton Hall, Westminster, 2.30 p.m.

Perfect Weather for the Ladies

LONDON AND SOUTHERN SECTION AT DOVER

A PROGRAMME packed with interest, combined with the good fortune of a sun-drenched day, made the summer meeting of the London and Southern Section of the I.G.E., at Dover on June 26, a perfect occasion.

In the morning members and guests inspected the Dover gasworks. The major reconstruction of this works, which includes the installation of Woodall-Duckham continuous vertical retorts, C.W.G. plant, tower purifiers and other ancillary plant, was described by Mr. R. G. A. Clark, M.B.E., Engineer of the Dover (Engineering) Division of the South Eastern Gas Board, in a paper presented to the Section on April 17.

Among the ladies who visited the works was Mrs. W. K. Hutchison, accompanied by her husband, Mr. Hutchison, C.B.E., Chairman of the South Eastern Gas Board. But as an alternative to this visit, a tour of Dover Castle proved very attractive to many of the ladies.

Historic Fortress

Dover Castle is an historic fortress with a fine old keep in the centre, surrounded by a ring of outer walls and towers, and dates from 1181.

Luncheon, at which members and their ladies were the guests of the South Eastern Gas Board, was in the early 13th century Maison Dieu Hall—Dover Town Hall.

Mr. J. M. Webber, Chairman of the Section, proposed the toast of the 'Town and Port of Dover,' and the Mayor, Alderman J. Williams, responded.

Mr. Hutchison, in the course of toasting the London and Southern Section, conveyed the good wishes of Sir Henry Jones, President of the Institution of Gas Engineers, who had 'an important engagement at Downing Street.'

'Agreeable Conditions'

The reconstruction of Dover gasworks, when finished, said Mr. Hutchison, would represent a modern works having the most agreeable conditions for both those who worked in it and those who lived near it.

He expressed the Board's great satisfaction with the work being done and congratulated the engineers responsible—particularly Mr. Clark, who was in charge of the old Gas Company in 1937 and throughout the war, defiant of enemy action, including the destruction of his own house.

Mr. Webber responded to the toast.

In the afternoon, a visit to the Dover Harbour Board's car ferry terminal was combined with a tour of the harbour in tenders, during which the train ferry, Admiralty Pier and other installations were seen.

Correspondence

Radiation and Gas Production

Reflecting on the subject matter of the papers presented and discussed (in too little time?) at the recent Institution Meeting, it may have occurred to many besides the writer, that one aspect of vast importance to the future of the fuel industries (among others) was mentioned only in passing, *viz.*, nuclear energy.

It is surely becoming increasingly obvious that the economic field in which the industry has to manœuvre, whether in manufacture or usage, is contracting progressively. Being harnessed to the raw material, coal, whose sole increase in volatility seems to attach to its price, and with an almost inevitable increase in handicaps to selling its gaseous products *vis à vis* other forms of domestic fuels, is there not a great need in the industry for an immediate search for some totally new channel of manufacturing technique?

It is in this connection that research in gas production might surely, with advantage, at least survey the field of enquiry as to whether and how, if at all, ray energy may have some place in, say, the purification of crude gas or even in the reconstitution of the crude gas on manufacture, by polymerization and the like.

The oil industry and, indeed, some branches of the chemical engineering industries, have already begun to use gamma and beta radiation on gas streams and various materials and for promoting chemical reactions. None can envisage what the results might be if such enquiry and experiment were essayed in the case of coal gas, but is it not worthy of the most serious and urgent consideration?

'INTERESTED.'

8th June, 1956.

North Western Gas Board Pegs Prices

£1 MILL. DEFICIT TO BE MET BY MORE EFFICIENCY

THE North Western Gas Board will not increase its prices for gas to any consumer, domestic or industrial, at least until the end of the present financial year, provided there are no further material increases in costs over which it has no control. This decision means that the Board faces a deficit this year of just over £1 mill., which it hopes to recover by increasing its efficiency.

Announcing this in Manchester, Mr. D. P. Welman, Chairman of the Board, said it included the special agreement to industrial concerns by which the Board had power to increase prices automatically with the rise in the price of coal.

The Board was in a very serious position, he said. Since the end of the financial year, costs of coal, freight, salaries and wages had risen by £1,969,000, the equivalent of £3 mill. over the whole year. Assuming similar trading this year as last year, it meant that the Board was facing a deficit of just over £1m. in the financial year. Next year it would be nearer £1.5 mill.

Charges Forced Up

Prices had been unaltered for two-and-a-half years until July last year. During that time, the Board had absorbed over £500,000 in increased costs. The increase of its coal bill by £3 mill. had forced up charges, but only enough to cover this higher coal bill.

At that time, the Board faced a deficit of £300,000, but it had more than recovered this by increased efficiency: Although its surplus had decreased in the last quarter because of the credit squeeze, it was 'satisfactory.' There was nothing in hand to face up to the £1m. deficit this year.

There were three ways in which the Board could meet this deficit. The first was to increase prices. That might affect our exports adversely. What we wanted was lower prices not higher, he added.

The second way was to carry a substantial loss in the Board's accounts. This was unrealistic and out of the question. It would be asking the public to subsidize the Board through taxation.

The third alternative was to improve productivity and efficiency. No industry was ever completely efficient. There was always something that could be done to improve it. During the last three years productivity had been improved by 12½%. He was confident that it could be improved even further but it would not be easy.

One of the nationalised industries, which raised its prices every 12 months had just announced there would be no further increase for the next twelve months. This was a hollow and meaningless gesture, he said.

The nationalised industries had to stand between the public and rising costs. The decision not to raise prices was not a heroic gesture on the part of the Board.

The North Western Gas Board, which covers the largest area in the country serves 1,680,000 domestic and 110,000 industrial and commercial consumers.

The North Western Electricity Board has also announced that it will not increase tariffs at least until March 31 next in spite of a substantial deficit in the current financial year. This will not include the automatic increases which apply to those consumers whose charges are subject to a coal price variation clause.

GAS COUNCIL ANNOUNCEMENT ON CHARGES

THE following statement was issued by the Gas Council after the Prime Minister's meeting with leaders of the nationalised industries:—

Each of the twelve area gas boards has the individual duty, imposed by Act of Parliament, of making its expenditure and income balance. Increased costs, when they have reached a stage where they cannot be absorbed by improved efficiency or internal economies, can be met only by adjustments in the price of gas or of other products of gasmaking.

All Area Boards

The Gas Council announces that all area gas boards, after they have made such revisions of price as most of them find necessary to meet increased costs of working as at June 1, 1956, including the increase in the cost of coal effective from that date, will keep the prices of gas unchanged at least for the rest of the current financial year—that is. to March 31, 1957, unless something quite exceptional and unforeseen occurs to frustrate that intention.

Mr. Sydney Smith (right), lately elected Chairman of the Scottish Gas Board, recently visited Dumbarton and Helensburgh undertakings and presented long service awards to employees with 40 years' service in the industry. He is seen here presenting a wireless receiver to Mr. James Dunbar, District Salesman, Helensburgh, watched by Mr. A. McFadyen, Engineer and Manager, Dumbarton and Helensburgh District.

SOCIETY TO MARK 75TH ANNIVERSARY

SCROLLS containing congratulatory addresses to the Society of Chemical Industry on its 75th anniversary will be presented at a ceremony in London on July 10.

Wearing academic dress, delegates from learned societies in Britain and abroad will present the scrolls to the President of the Society, Mr. Julian M. Leonard, at the Royal Institution.

Nearly 1,000 members and guests from this country and from overseas will be attending the 75th annual meeting of the Society from July 9-14 at the Royal College of Science.

NEW LONDON OFFICE

Charles Carr Ltd., of Grove Lane, Smethwick, 40, Birmingham, have opened a London Office at 19, Great Winchester Street, London, E.C.3. (Telephone Nos. London Wall 6714/6715.) Enquiries will be dealt with either by the Company's head office or by their London representative, Mr. F. A. Blake.

Ironworks to Spend £3.5 mill. on Development

EXPENDITURE of approximately £3.5 mill. on development at Stanton Works is announced by the Stanton Ironworks Co. Ltd.

The scheme, which has been authorized by the Iron and Steel Board, will take two-and-a-half to three years to complete and consists of the provision of an integrated ore preparation plant, including crushing, bedding, screening, and sintering.

The prepared ore will be transferred to the Company's two blast furnace plants by an extensive belt conveying system.

The plant is designed to improve the efficiency of blast furnace operation and to enable the Company to use reserves of ore which are unsuitable for use without preparation.

'GAS INDUSTRY AT CROSSROADS'

Woodall-Duckham Ready to Follow Road Chosen

CHAIRMAN'S SPEECH AT ANNUAL GENERAL MEETING

TECHNICALLY, Britain's gas industry seemed to be at a crossroads, said Mr. T. Campbell Finlayson, Chairman, at the annual general meeting of Woodall-Duckham Ltd., last week. It was the aim of the Woodall-Duckham group to be ready with suitable plant whichever road was followed.

If, as seemed quite likely, the clean air policy led to a greater demand for smokeless solid and gaseous fuels, the group could provide well proved, efficient plants to produce them. If, on the other hand, the gas industry wished to make gas from non-coking coals hitherto not employed for gas manufacture, the group could provide suitable plants of which there was an example now in full operation in London. This plant, which incorporated the Gas Integrale system of complete gasification, had been built on a commercial scale by the principal operating company on one of the works of the North Thames Gas Board.

Alternate Plants

Alternatively, if the gas industry required to make gas from oil or from hydro-carbon gases, the principal operating company could provide plants of two alternative types and was at present building an example of each, together with a second complete gasification plant of the G.I. type, for the South Western Gas Board.

The Directors would like to express their indebtedness to these two gas boards for their co-operation in establishing these new developments in Great Britain. The carrying out of this type of development work—even with this co-operation—was expensive, and was the reason why large sums had been set aside for research and development.

To meet changing conditions, it was planned to maintain existing activities at maximum efficiency; to develop new processes, and to acquire new lines of business which appeared promising, the Chairman concluded.

The value of work carried out in 1955 by the operating companies of the Woodall-Duckham group exceeded £13 mill. compared with £14 mill. for 1954, a record year.

Orders received during 1955 exceeded £12 mill., against £8.3 mill. during 1954, with unexecuted orders at end-1955 still exceeding £25 mill. Without allowing for any further orders, full employment of the group's organization was assured for the next two years, the Chairman had earlier told the meeting.

The announced final dividend of 20% on ordinary gives a total of 25%, the same as for last year.

Group trading, etc., profit improved from £1,199,064 to £1,208,474. After depreciation, pensions, etc., the untaxed profit is £1,042,682 (£1,039,932).

The Directors and Alternate Directors of George Wilson Gas Meters, Ltd., of Coventry, are seen at a recent dinner, following a meeting with executives of their Jarrow factories, at the Marsden Grotto, South Shields.

H.P. Curbs Hit Appliance Sales

GLOVER AND MAIN GROUP PROFITS DIP £200,000

HIT by hire-purchase restrictions, trading profits of the Glover and Main group dropped from £867,000 to £651,000 last year, the annual report reveals. Little hope of an improvement this year was held out by Col. W. R. Glover, C.M.G., Chairman, at the annual meeting, recently.

However, despite the drop in turnover, the group is securing a bigger share of the reduced market, its decline in output being only half that of the industry's reduction as a whole.

The group, which supplies more than a quarter of the country's domestic cooker needs, increased its space heater sales during the year under review and maintained healthy business in catering and hotel equipment.

Work on the projected new refrigerator factory would not be resumed until future demand could be more clearly seen, the Chairman said.

Final dividend recommended on the Glover and Main, Ltd., Ordinary capital was 1s. 1½d. per share which, with the interim paid of 3d. per share, makes a total of 1s. 4½d. for the year. This means that shareholders who exchanged their £1 Ordinary shares for four 10s. shares will receive the same gross dividend as for 1954.

THOMAS DE LA RUE TO PAY 20% FINAL

PROFIT for the year ended March 31, 1956, of Thomas De La Rue and Co., Ltd., was £911,645 the preliminary announcement for the year reveals. This compares with £834,617 for the year ended April 2, 1955. Tax took £592,342 (against £547,830).

Final ordinary dividend of 20% is proposed (against 22%) making, with the interim, a total of 30% (same) absorbing £159,735 (£157,883).

Capital reserves (including share premium reserve) were £434,308 (£533,337); general reserve, £1,300,000 (£1,000,000); tax equalisation reserve, nil (£200,000); appropriation account—undivided profits —£407,134 (£282,629).

The annual general meeting will be held on July 25.

CANNON HOLDINGS PASS INTERIM

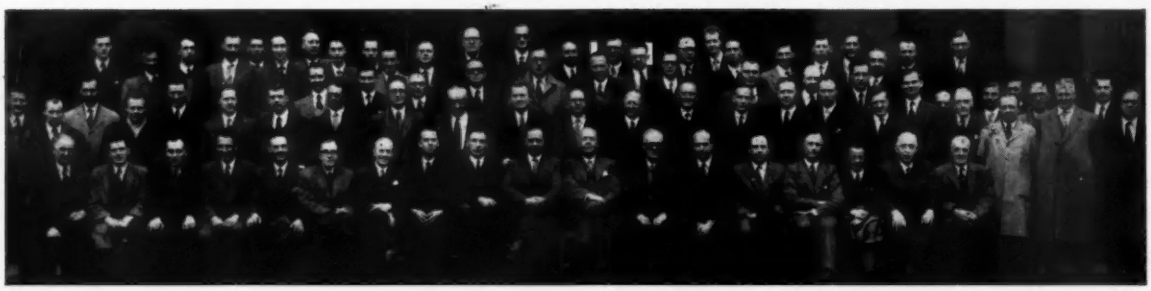
THE Board of Cannon (Holdings) has decided not to pay an interim dividend on the £300,000 ordinary capital in respect of the year ended June 30.

The sole reason, it is stated, for the passing of the interim is a serious recession of orders for domestic gas appliances brought about by Government legislation.

For the previous year, an interim of 10% was followed by a final of 20%.

The current half-year's dividend on the 5½% preference will, however, be paid on July 1.

NORTHERN JUNIORS HOLD ANNUAL MEETING



Members at the Ormesby Works of Cochranes (Middlesbrough) Foundries, Ltd.

Industry Fighting for Efficient Engineers, says President

UNLIMITED SCOPE FOR WELL TRAINED INTELLIGENT MEN

IN the present period of full employment every industry was fighting to capture the more efficient engineers and technicians and promising recruits, said Mr. P. N. Lee, President, at the annual general meeting of the Northern Junior Gas Association, in Redcar recently.

By comparison with the splendid conditions described in advertisements for some other industries, the gas industry was apt to look shabby and out of date, the President continued.

But these comparisons could be misleading. It was for the good of the country that the 'dress allowance' of the gas industry had been cut. It was certainly not out of date—it could not afford to be—and in fact some of its modern developments would be hailed as spectacular if they had been introduced by a more fashionable industry.

In all branches of the industry the scope for well-trained men of intelligence was almost unlimited. Fresh ideas were welcomed eagerly and often rather uncritically, but for the good of the industry it was better that ideas should be expressed with some regard for practicability.

Ideas into Action

Even the most straightforward operation, if examined carefully, might be altered in some small way to effect a saving of effort or money. The need today was for men who were ready to say 'Yes' to new ideas and then transform the ideas into action no matter what the difficulties.

The training of the younger members was continually being discussed and altered in order to provide a regular stream of younger gas engineers. The Northern Gas Board was trying to attract and encourage new entrants by providing all possible forms of opportunity for education, by payment of fees, day-time courses, and sandwich courses.

Such inducements had been unknown in earlier days and yet we had been, perhaps, better off then. We had been free to study or not as we pleased.

The present element of compulsion appeared to reduce initiative. For example, the Woodall-Duckham Scholarship Award of £750 had just had to be postponed for lack of an applicant.

Greater enthusiasm for study might be developed by the replacement of these 'educational subsidies' by a substantial reward for qualification.

The Institution of Gas Engineers was once again considering a revision of the education regulations to provide a more specialist course of instruction. But the greatest need was for all round gas engineers capable of concentrating their efforts in one particular direction, to become experts in production or utilization, or in phases of these activities.

Wide Training Needed

For all who wished to progress in the industry, and who possessed those more intangible qualities of temperament and personality required for the senior positions, it was necessary to continue training in directions other than the purely technical.

The function of management known as industrial relations was first practised by a junior assistant when he was given a small job to supervise and one or two men to control. The techniques of leadership and efficient organization could only be fully acquired by the most careful attention to the requirements of this and succeeding tasks.

In our endeavour to develop all round abilities, it was our duty to consider the safety of those for whom we were responsible. We should take a particular interest in the reports of the Safety Precautions Sub-Committee.

A knowledge of accountancy—perhaps domestic economy was an apter term—was essential to full development. It was far more important to control inefficiences and wastages as they occurred than to account for them some time later.

Greater financial freedom, if given to individual undertakings, would demand a greater detailed knowledge of the finances of such undertakings, but it could provide opportunities to develop minor ideas without detailed and minutely costed estimates—a bright idea was often lost when trying to make an accurate estimate of its cost and economic justification.

He was still convinced, concluded the President, that the main virtue of any gas engineer was that reliability on which the country had come to depend. Whilst every effort should be made to promote efficiency and develop new methods, the average gas engineer would devote most of his time and energy to the ordinary humdrum tasks of keeping the wheels turning.

Officers Elected

At the conclusion of the address, the following officers and council for the session 1956-57 were elected: President, J. C. Graham, Newcastle-on-Tyne; Senior Vice President, C. W. Robson, Newcastle-on-Tyne; Junior Vice President, R. S. Longhurst, Carlisle; Honorary Secretary, R. Aynsley, Newcastle-on-Tyne; Honorary Treasurer, C. H. Ling, Darlington; Honorary Transactions and Publicity Secretary, R. S. Longhurst, Carlisle; Council—L. Nelson, Blyth, and G. E. Haddon, Stockton; Northern District Education Committee—C. Hindle, Darlington, G. E. Haddon, Stockton-on-Tees, and P. N. Lee, Middlesbrough; Auditors—A. O. Old, West Hartlepool, and D. Yule, South Shields.

The retiring President, Mr. P. N. Lee, referred with regret to the absence of the President Elect, Mr. J. C. Graham, of Newcastle, who was on a training course. Under the circumstances the Senior Vice President, Mr C. W. Robson (Newcastle) took over the chair and conducted the meeting.

Mr. Robson presented the S.B.G.I. Silver Medal to Mr. J. T. Lewis, of Howdon, for his paper entitled 'Sulphate of Ammonia Production.'

The Certificate of Office was then presented to the retiring President, who expressed his thanks for the support he had received during his year of office.

After the meeting members were entertained to lunch by the Northern Gas Board, Tees-side Division, and in the afternoon a visit was paid to the Ormesby iron works of Cochrane (Middlesbrough) Foundries, Ltd.

LONDON SECTION'S DAY AT DOVER

Pictures of the Summer Meeting

(See p. 27 for full report)

Top, left: *Stephen Tennant, Staff Photographer, took this picture of members re-assembling after their tour of Dover gasworks, from the top of a tower purifier.*

Left: *A group inside the retort house.*

Below, left: *Aboard one of the Dover Harbour Board's tenders.*

Below, right: *Mr. J. M. Webber, speaking at the luncheon.*

Left: *Mrs. Clark, Mrs. W. K. Hutchison, and Mr. R. G. A. Clark,* M.B.E., *Engineer, Dover (Engineering) Division.*
Right: *All aboard is another group of guests of the Dover Harbour Authorities.*

CRUISING DOWN THE RIVER

Sun Not Missed on London Juniors' Ladies' Day

THE sun peeped and tantalized but failed to pay full compliment to the ladies on Ladies' Day of the London and Southern Junior Gas Association on June 23.

But the finale to an imaginative and never-a-dull-moment programme defeated the sultry atmosphere in London that day. For immediately after luncheon in the Festival Hall Restaurant, which overlooks the grandest of Thames views, members and guests embarked for a pleasantly cool launch tour of the Pool of London.

Nine Elms Works Visited

Earlier, also by invitation of the North Thames Gas Board, members had seen the Nine Elms works. There, they were particularly interested in the new reinforced concrete jetty and coal handling plant and the recently reset Glover-West continuous vertical retort house.

Ladies who turned up for this part of the day were entertained to coffee and were able to inspect a mobile showroom.

Ghosts from the Past

Mr. Michael Milne-Watson, C.B.E., Chairman of the North Thames Gas Board, proposed the toast of 'the Association' and pointed out that the Juniors' trip that afternoon would take them through reaches that were, 100 years ago, crowded with collier brigs that brought coal for their works from the North. 'As you go down river you will pass ghosts of famous gasworks: Horseferry Road, Blackfriars (you will see the tunnel where the coal was taken under the road into the gasworks), Wapping, and many other famous works, now closed down.'

Mr. N. R. Junkison, President of the Association, replied.

On the launches, the 300 members and guests were shown through the Royal group of docks, taking tea in the saloons.

GAS BOARD DRIVERS RECEIVE AWARDS

SAFETY-FIRST diplomas were presented to drivers of the Scottish Gas Board, Western Group, in the gas showrooms, Greenock, recently, by Chief Constable Gray.

Mr. A. Jamieson, Group Manager, said that the Gas Board was doing all it could to encourage drivers to be active participants in the safety scheme.

Those who received certificates were James Worthington, David McCann, and Wm. McQuarrie, Greenock; Archd. Brown, Largs; D. Canning, Rothesay; Allan Craig, James Devenney, J. McMeney, and Robert Thomson, Paisley; John Kerr and John Fancy, Irvine; Ronald Forbes and M. Muir, Saltcoats.

A comprehensive display was seen on the Gas Council stand (above) at this year's Royal Highland Show, Inverness, while the Scottish Gas Board provided a demonstration kitchen. Of special interest were a tea brewing machine by W. M. Still & Sons, Ltd., and a Clark 'in bin' grain drying furnace. Thomas De La Rue & Co., Ltd., showed their Warwick cooker and Diplomat boiler.

London to Stage World's Largest Fuel Efficiency Exhibition

WAYS in which industry can save up to one-fifth of fuel costs—often a great deal more—together with the latest information about nuclear power stations, will be on show in the autumn at London's Olympia.

This will be the Fuel Efficiency Exhibition from October 2 to October 10, which will be opened by the Minister of Fuel and Power, Mr. Aubrey Jones. It will be the largest of its kind in the world.

About 150 firms will be showing special equipment designed to produce fuel economy in all branches of industry. The equipment shown will include the latest types of fuel burning devices for both solid and liquid fuel; the latest developments in insulating materials; and every conceivable type of automatic-control equipment—all designed with the object of reducing fuel costs.

Series of Talks

During the course of the Exhibition the Institute of Fuel is organizing a series of talks and discussions with the title, 'The Efficient Use of Fuel in Industry.'

The dates for the different subjects will be:—October 3, 'Efficient Use of Coal'; October 4, 'Efficient Use of Oil and Gas'; October 9, 'Heat and Power Surveys and Waste Heat'; October 10, 'Clean Air and Industry," followed by free discussion and a summing up of the four sessions.

Many leading experts will be giving addresses, among them Mr. R. Nichol, of Arthur Guinness, Ltd. ('Efficient Use of Coal'), and Mr. George Richardson of Shell Mex and B.P. ('Efficient Use of Oil.'),

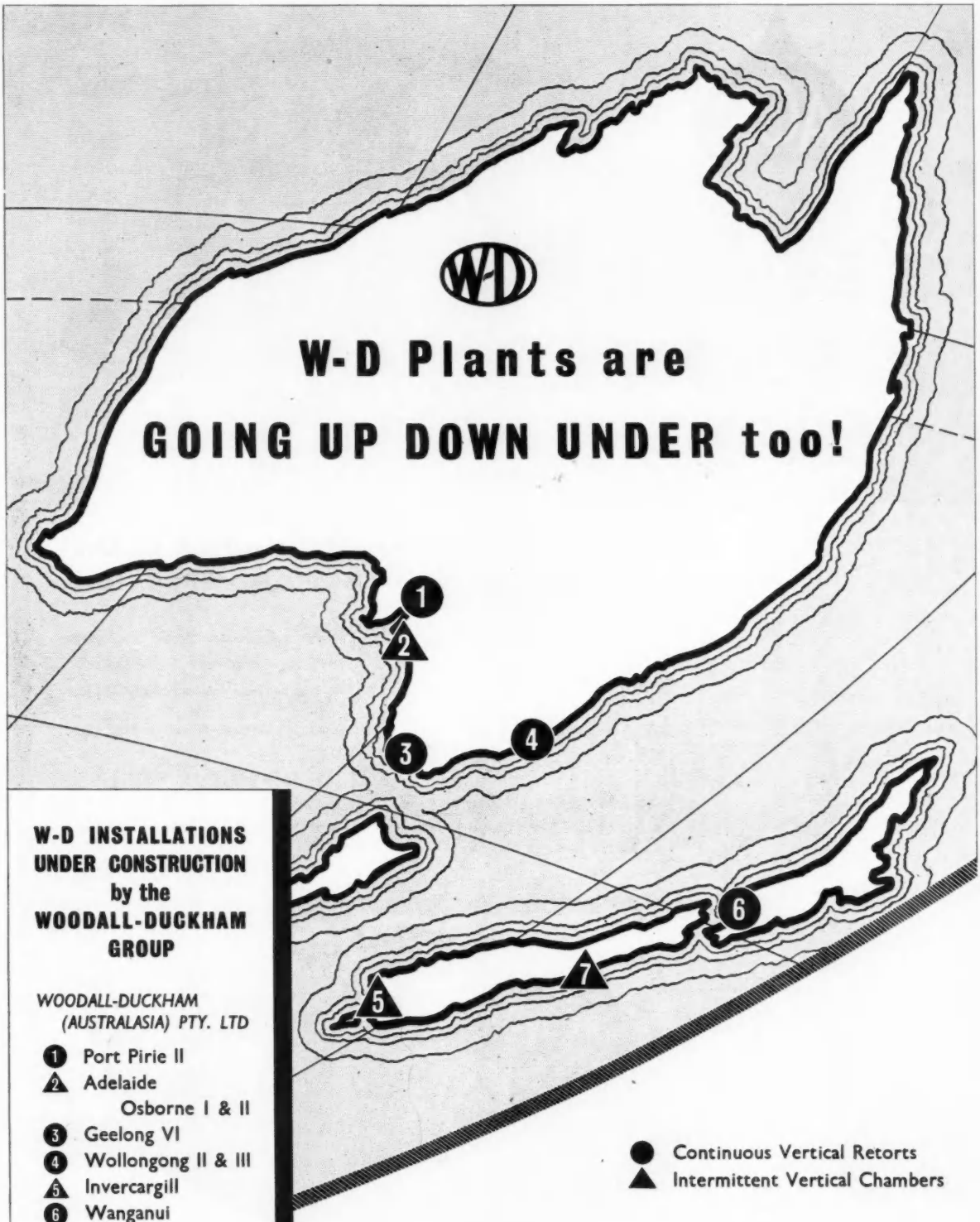
REFINERY GAS REFORMING AT ROMFORD

The North Thames Gas Board has awarded a contract to Humphreys & Glasgow Ltd., for the installation of four refinery gas reforming plants at Romford in Essex. The purpose of the new plant is to convert refinery gas into town gas of normal calorific value and characteristics which will be fed into the Board's grid. The total installed capacity, including 'standby,' will be approximately 36 mill. cu.ft. of town gas daily.

A ten-year agreement between the North Thames Gas Board and Shell provides for the supply of 25 mill. therms of refinery gas per annum from the Shell Haven refinery on the Thames Estuary.

The plants to be installed by Humphreys & Glasgow will be of the self-steaming type, using the Onia-Gegi catalytic conversion process. The installation has been designed to handle the daily supply of refinery gas in any three of the four sections of plant. Under peak load conditions the fourth set can be brought into operation.

The plant will be erected in the open with buildings to house the controls, machinery, and boosters. The contract includes all civil engineering work and ancillary plant.



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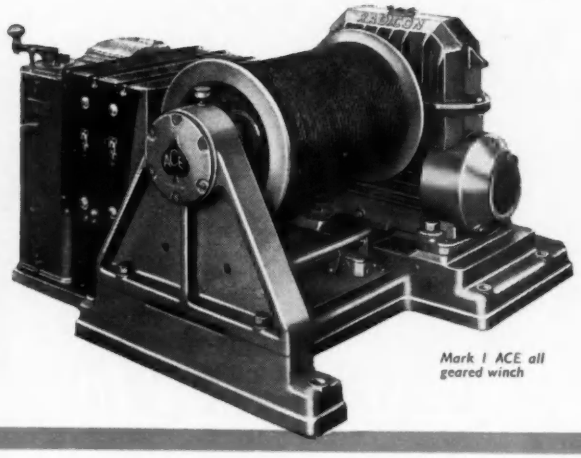

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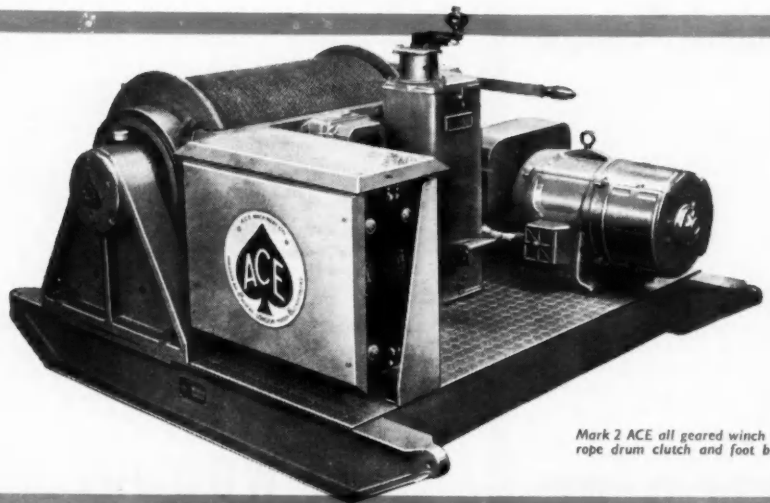

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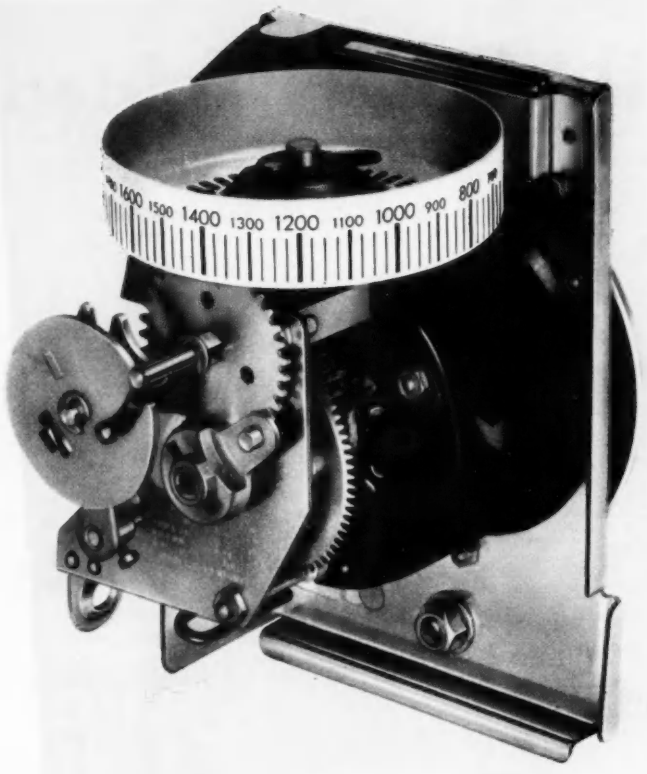

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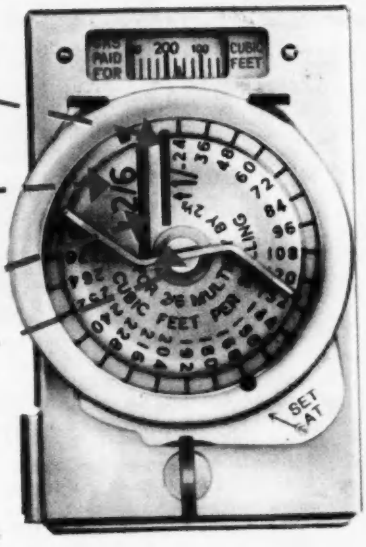

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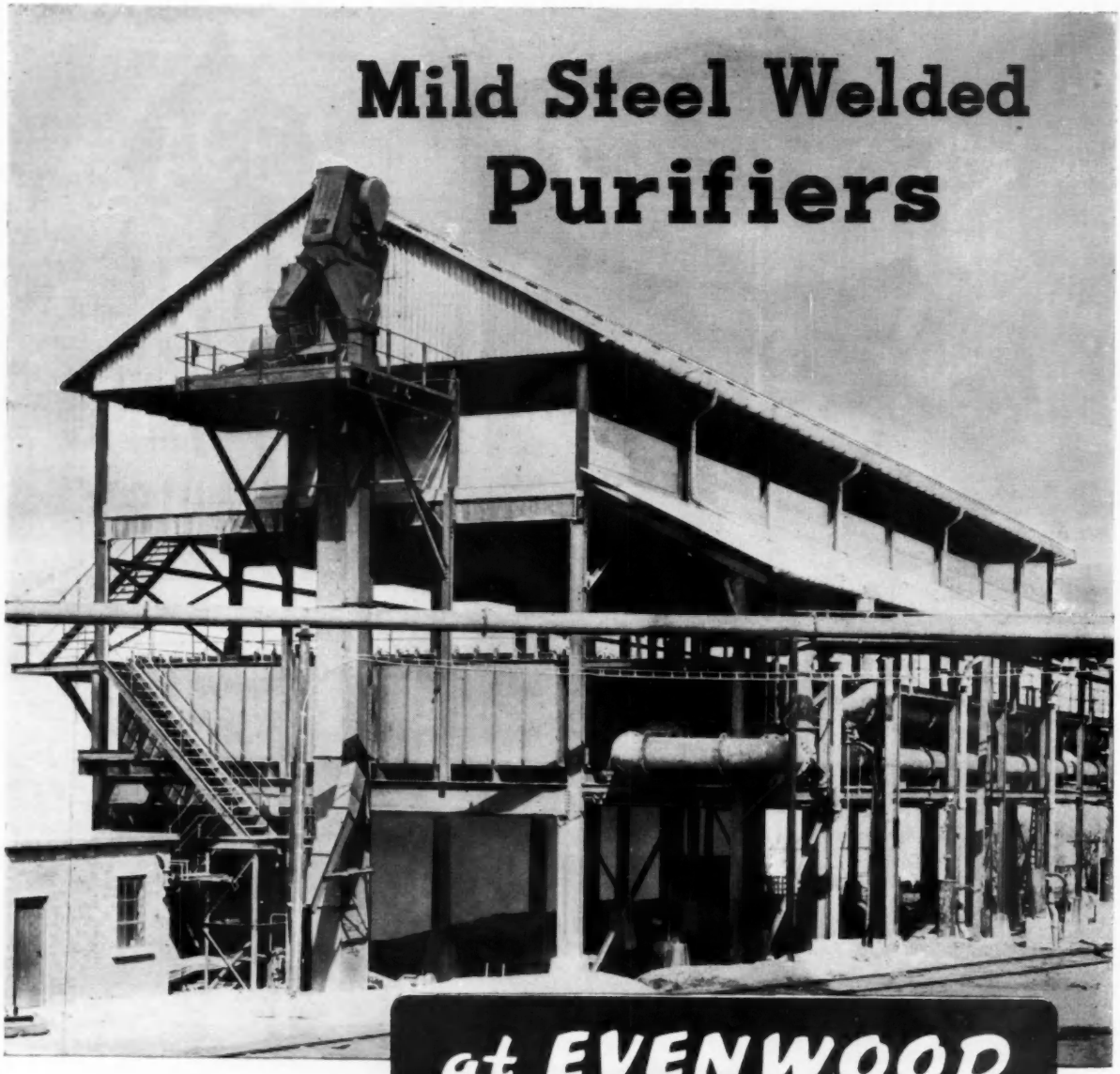

at EVENWOOD

This purifier installation comprises four Mild Steel Welded Boxes which are capable of handling 3-mill. cu. ft. of gas per day and have been prepared for further extension.

The Purifiers are housed in a steel-framed building with overhead concrete revivifying floor and oxide handling equipment. Photograph by courtesy of Northern Gas Board and Sadler & Co. Ltd.

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'WORLD ENERGY RESOURCES IN THE LIGHT OF RECENT TECHNICAL AND ECONOMIC DEVELOPMENT'

IMPRESSIONS OF THE FIFTH WORLD POWER CONFERENCE

Specially written for 'GAS JOURNAL' readers by

G. H. W. MADGE

WHEN asked to write a short article on the 5th World Power Conference from the gas industry's point of view I accepted with reluctance because even at that time I had some glimmering of the difficulty of the task due to the wide scope of the conference. After accepting I looked for the first time at the mass of preprints of papers and reports which had been sent to me as a participant and weighed them physically and mentally. The physical weight was easily ascertained—30 lb.—but the mental weight was quite awe-inspiring.

An initial attack of acute intellectual indigestion was followed by an abiding depression, for how could anyone do justice to such a subject in a few thousand words and a few hours of time? Reference to the Editor provided the first ray of light. All that he wanted was 'a signpost to the papers.' Thus encouraged I consulted my colleagues and travelling companions and set about ruthlessly to reduce the number of papers and reports for consideration to more manageable dimensions. The result was that a package of 48 papers and reports weighing a mere 6 lb. or so was included in luggage for the air journey.

The General Reports numbered seven, representing the sections covering national power economies, the preparation of solid and gaseous fuels, long distance gas transmission, the production of atomic energy and other sources of energy, solar, fuel cells, heat pumps, etc. All these were in English. There were 41 papers including a number of direct interest to gas engineers.

While 'the signpost to the papers' had become fairly visible in the prevailing technical mist, it could not be said that it was by any means clear or readable. The report and papers retained were still too numerous to permit of any proper assessment of the entire number and it was decided that in general signposting must consist simply of drawing attention to the salient features of those papers particularly concerning the gas industry. Comment concerning the discussions might be given in those cases where the writer or one of his colleagues was present.

There were 3,000 participants of whom the British contingent accounted for 240, 22 of them representing the gas industry.

There was an Austrian General Reporter for each section whose broadly based contribution was supported by papers on special aspects of the subject by various experts.

An unusual feature of the discussions was that the speakers did not necessarily speak of their own papers; instead, unless they had something to add to the paper submitted, they generally did not.

Speakers taking part in the discussion could deal with any matter within the orbit of the General Report and of the papers submitted in the particular section. This made discussions very hard to follow, despite an excellent interpreting service. I have presented notes of the various discussions which I attended. An appendix of notes on selected papers has also been provided.

In two of the three conference halls every member of the audience was provided with a tiny radio set giving a choice of interpretation in three languages. In the third room a more conventional wired scheme was in use. All were excellent.

I attended the opening ceremony in the Burgtheater. This superb building has been recently restored and is probably unmatched by any theatre in the U.K. While the ceremony in the Opera House is understood to have been equally impressive in its way, it was comparatively official, consisting largely of speeches interspersed with a little orchestral music.

The speech made by the President, Sir Harold Hartley, has since been favourably reported on by the Press of the world and is given at some length in *Weltkraft In Wien*, the daily conference newspaper. This speech, probably more than any other, set the high tone of the conference.

The performance in the Burgtheater, we are happy to say, was quite unconventional and altogether delightful. Between the hours of 11 and 1.30 we were entertained gloriously by the Vienna Symphony Orchestra and by the Vienna State Opera Ballet.

Addresses of welcome were given by the first Vice-President of the Austrian National Committee and by the Mayor of Vienna.

An unusual touch, in my experience anyway, was provided by a Prologue, spoken by three different actors successively in German, English and French. There is no doubt that the style and presentation of this opening ceremony appealed greatly to the large audience who doubtless expected a formal and rather trying conventional opening, but saw and heard instead a highly entertaining programme of unusual artistic merit. Let it be said to the further credit of the show that it took place on a brilliantly sunny Sunday morning when the call of the open air, after a period of indifferent weather in the U.K. and Europe generally, was strong indeed.

The Technical Sessions

The morning session was devoted to Sections A and B of which the general themes were respectively 'Survey of the development of the National Power Economies from 1950/54,' and 'The methods of compilation and use of statistics in the production and utilization of energy.' These had produced a very large number of papers of infinite range and of general as well as of specialized interest. It is possible only to give the briefest commentary on the many important contributions but the following appeared to the writer to be of particular interest to the U.K. participants.

Mr. P. T. Cox, speaking on the paper, 'The Middle East as a Factor in the Pattern of Oil Supply,' endorsed the statement that 'The centre of gravity of world oil production is shifting from the Gulf-Caribbean area to the Middle East—to the Persian Gulf area—and is likely to continue to shift until it is firmly established in that area.' In his remarks Mr. Cox showed by a table how the pattern of oil production had changed in the years 1900-54. The Middle East did not figure in the table until 1920, when its percentage of world production was 1.8. By 1954 the percentage had risen to 14.8 which gave the Middle East second place to U.S.A. whose percentage was 45.6, having declined steadily since 1945.

Dealing with crude oil reserves 'proved' and 'ultimate,' Mr. Cox showed that the former added to the cumulative production to date had reached a figure of 99,494 mill. barrels at January 1, 1955, out of a world total of 227,440 mill. barrels. The U.S.A. contribution to the world figure was 80,466 mill. barrels. Thus on this basis the Middle East must be regarded as the greatest potential field for oil production.

A Russian delegate spoke on water power and dealt with his large subject in an interesting way. We learned incidentally that the construction cost of plants in Siberia is lower than elsewhere in the Soviet Union due (let it be understood) to the saving of concrete made possible by the rocky soil in which the Siberian plants are built.

Another Russian produced a wealth of statistics to show how rapidly production of electric power is growing, and the great importance attached to this speedy growth by the U.S.S.R. He referred to boiler plants operating at a pressure of 200 atmospheres (the critical point of steam) and he told of the first atomic power station which was brought into use in 1954; it has an output of 5,000 KVa. More such atomic plants are under construction.

Mr. Hunter (G.B.) gave us a great deal of useful information on the subject of capital investment in the course of which he stressed that capital investment in electrical power must keep in step with capital investment in other industries if economic balance is to be maintained. Living standards are linked to the extension of electrical services.

It is easy, especially in a small expanding country, for the ratio of capital expenditure on electricity to overall capital investment to get out of hand. He showed how relatively close is this ratio in highly developed countries where it is of the order of 8%. This, in his view, indicates a stable economy.

There was a great deal of applause for Mr. Hunter at the conclusion of his remarks.

Coal Supply in Britain

Dr. Daniel (G.B.) (Chief Statistician, Ministry of Fuel and Power), on the subject of the world fuel position, quoted references and expressed the view that atomic energy cannot help materially for two decades yet. Therefore, the development of indigenous fuel (coal) production must be speeded up. He said that the coal industry in Great Britain presents special difficulties because of its age. Many of the pits are old and have been worked for a very long time. Additionally, in Great Britain the industrial situation is such that it is very easy for miners to move into other industries.

He mentioned the Coal Board's plans to raise coal production to 250 mill. tons per annum within a few years, which could require a capital investment of £1,000 mill. There have been difficulties in other countries too, even in North America, due to the competition of oil and of natural gas.

Dr. Daniel asked that the rising prices of fuels, especially coal, should be given prominence in future reports.

Mr. Anderson (G.B.) doubted whether the use of gas turbines running on peat could make a serious contribution to the fuel problem. He preferred direct firing of boilers by peat. The capital investment required for building peat burning stations would not be much less than that required for atomic energy stations.

A Japanese delegate, speaking on coal production in Japan, said that production was now approaching the pre-war level. Wages had greatly improved. Welfare expenses were increasing.

Mr. Eccles (G.B.) initiated a discussion on 'Energy Statistics' and said that the reports dealt with energy reserves and with energy consumption. In simplest terms: Much use—little reserve—a long-term problem; little or static use—much reserve—a short-term problem. In his opinion there was much scope for calculation of the economics of converting fuel into a more convenient form at the supply source instead of transporting the raw fuel. The speaker referred to the considerable economies being effected by electricity generation in the coal field.

He expressed the hope that when future sessions of the World Power Conference are being planned there will be a free flow of information on atomic energy. In the meantime the recovery of sufficient fossil fuels is the pressing problem.

The afternoon session was split into two halls and devoted to consideration of Sections C and G, which dealt respectively with Preparation of solid fuels, and Thermal power plants—technical problems of the mechanical equipment.

I spent the better part of the afternoon listening to speeches on section C, 'Preparation of Solid Fuels.' Contributions were made by British, Russian and French speakers, of which one of the longest and possibly most significant was by Dr. J. Bronowski (G.B.). A paper on 'Recent Research and Developments in Great Britain in the Thermal Treatment of Coal,' by Dr. W. Idris Jones, described various processes being developed for making smokeless briquettes from weakly caking coals, in the course of which a new process of carbonisation, with an exceptionally high throughput, had been evolved. Brief description was given of current research on the fundamentals of the coking processes.

The following afternoon was spent in consideration of Section E, the Gasification of Fuels, and the Preparation of Gaseous Fuels. The General Reporter (See p. 37) expressed regret that underground gasification was not represented in the papers submitted in Section E, and asked that it should be mentioned in discussions.

The following speakers were of special interest to the gas industry and their more significant comments have been noted.

Oil Gasification

Mr. J. E. Davis (G.B.) in his paper 'Petroleum Products as Raw Materials in the manufacture of Town Gas in Britain,' spoke of the additional information which had become available since his paper was prepared. Coal prices had continued to rise relative to oil prices, which fact had obvious implications.

The Clean Air programme made a demand for coke—hence a decline in the number of C.W.G. plants under consideration. The availability of oil gas processes acquired added importance and Mr. Davis referred to the two schemes now in hand for the gasification of oil products, both in the Thames Estuary. These two plants were respectively the North Thames Gas Board scheme for carrying refinery gas from Shell Haven to the Romford works and there reforming it, and the South Eastern Gas Board's scheme for building an oil gas plant alongside the Kent refinery. Each plant, in its first stage, would produce 25 mill. therms annually. These two plants illustrated the new functions of the gas industry.

Sir Henry Jones (G.B.), speaking in the discussion on some economic aspects of the gasification of fuels, got right down to fundamentals. He pointed out how town gas, being capable of close control, was popular and was widely used both domestically and industrially. There was, however, competition from some other form of energy in nearly every process. The cost of gas was made up of production cost plus distribution cost. The cost of distributing gas might well compare favourably with other fuels so the matter largely resolved into one of production cost.

He went on to speak of the principal sources of gas supply, namely: 1. Natural gas with which production cost is exploitation cost; 2. gas made from coal and oil in which the gas must of necessity be dearer than the raw therm; 3. gas made from coal or oil in processes by which by-products are recovered. Sir Henry went on to say that natural gas could often be cheaper than coal or oil but complete gasification processes must result in a product much dearer than coal or oil, but it may still be attractive.

The conclusion reached was that in Great Britain the gas industry must try to get as much gas as possible from coal in processes producing coke and to get the balance from the refining of oil. Processes should be capable of using the cheapest materials including high ash, coal and high carbon oil. Oil gasification plants should be situated near the source of raw material.

An Austrian delegate, speaking on the complete gasification of coal said that the patents went back to 1900. After World War II the concept of complete gasification was accepted in most European countries. The possibility of the use of non-caking coals was a good reason for introducing complete gasification. Great Britain, Japan and Italy were quoted as examples of countries where development is taking place. Italy, of course, had long been concerned with the efficient use of coal as an importer.

Slides were shown of plants in various parts of the world including some of the Kensal Green works of the North Thames Gas Board.

M. Loison (France) said that gas consumption in France was increasing at the rate of 3.5% per annum despite a certain decline in the use of gas for small industrial furnaces. Recently

petroleum gases had been introduced into the town gas supply but even so the output of gas produced from coal represented some 80% of the total and was rising every year. Thanks to the number of types of coal now used for coke and gas making and to the increasing use of coke ovens, there were plenty of opportunities for expanding the use of gas made from French coal. Research was concerned with the use of low quality coals and with improving the efficiency of gas production.

Dr. J. Burns (G.B.) said he had followed with great interest the contribution of Dr. Schissl on the Gas Integrale process, of which he had had first-hand experience at Kensal Green, and in his opinion the process must be compared with other processes for suitability on the basis of (i) base load and (2) seasonal load. The G.I. process had proved useful for (2) but was not quite so flexible as C.W.G.

Long Distant Gas Transmission

The afternoon was spent on Section F—the Economic and Technical Requirements for the Establishment and Operation of Long Distance Gas Supply Systems.

M. P. Courltet (France) said that he wished to add something to the paper 'Les transports de Gaz en France.' France was using a similar formula to the U.S.A. (Panhandle) but he made a plea for a universally acceptable formula. The French were using pipes 33⅓% thicker than were used in the U.S.A.; they employed butt welding and relied on cathodic protection. Distribution pressures were about 900 lb. per sq. in.

Mr. Sayers (G.B.), speaking on the corrosion and cathodic protection of pipes pointed out that with regard to the reference to this subject in the General Report cathodic protection of one installation might have damaging effects on another installation in the same vicinity.

Mr. W. T. Hird (G.B.), referring to the General Report, said that the gas industry must draw its supplies from many sources, e.g., natural gas, oil refinery gas, methane from coal mines, blast furnace gas, etc. He made a plea for standardization of practice in regard to flow formulae, safety requirements, materials, methods, costs, metering, etc.; there was much difference of opinion on these points even in our own country. He asked for information about maximum permissible velocities in pipe lines in which dust, under conditions of excessive velocity, can cause serious corrosion of the metal.

Mr. E. M. Edwards (G.B.) said that the distribution of gas made from oil products and of refinery gas was one of increasing importance. The economics of distribution could not be considered in isolation for production, storage and distribution are really one problem. The criterion of worth was the cost at which the gas could be put into the local distribution system.

He advanced the case for high pressure hydrogenation. He mentioned that the Wales Gas Board is to construct a methane grid from which a gas containing 55% C.H4 would be processed and mixed for town supply. The methane would be drawn from coal mines. He thought that new gas production plants should be situated near the coalfields or oil refineries which were the sources of supply.

Natural Gas

M. Fouchier (France), in his paper 'Le developement des ressources en gaz natural dans le Sud-Ouest de la France et ses repercussions economiques' said that additional information was now available on reserves of natural gas which were currently estimated at 100 billion cubic metres. The growth in availability of natural gas was expected to be such that by 1961 there would be available an annual quantity equivalent to twice the present consumption of town gas in France. A new grid would have to be constructed in accord with Gaz de France. Natural gas would be sold at a price irrespective of use which will depend on distance from deposits, quantity taken, load factor, etc.

Mr. Biggs (Canada), speaking on the paper 'Economic Requirements for the Establishment and Operation of Long-distance Gas Supply Systems, etc.,' referred to his experience in Saskatchewan, Canada, where the population to be served numbered 1 mill. only in an area of 100,000 square miles. Generally the towns supplied were small or very small. The natural gas fields were situated at outlying points and 100-300 miles transmission was common. The price of gas to the consumer however depended on the size of the community and not on its distance from the source. It was 20-30% cheaper than coal or oil.

In Saskatchewan, there was enormous variation between winter and summer loads, and whereas the demand for natural gas per small domestic house was at the rate of 30,000 cu.ft. per month in January, it was nil in summer time. There was thus a low load factor and as yet there was little industry to correct it. A good deal of natural gas was used on power plants. The design of the grid was based on delivering the requirements for the next 10 years without increasing distribution pressure. On the subject of reserves Mr. Bigg's explanation was that the supplies of natural gas should be assured for 30 years.

There was integration of gas and electricity undertakings on the commercial side and generally the use of electricity was not pushed where gas was available and suitable for the purpose.

A Russian explained that in the U.S.S.R. automatic welding techniques was used. This was a Russian discovery. Welding was carried out in the open air in any weather and cathodic protection was employed. An investigation into internal corrosions was to be made; mechanized pipe laying was in use.

Dr. R. Girotti (Italy) in his paper 'The Italian Long Distance Natural Gas Transmission System' explained that one of the differences between U.S.A. and Italian practice was that Italy cannot use pipe line travelling machines owing to the claims of agriculture and that great difficulty was experienced because of the number of easements required. Good results had been achieved with P.V.C. protection of pipes.

An Austrian, speaking on the General Report, regretted that the conference included no paper on Austrian natural gas, of which there were two types of source, wet and dry. In his opinion by a proper gas economy the imports of fuel oil into Austria could be very substantially reduced.

In Vienna town gas was largely used for heating which was associated with a low load factor. However, by control of output the Vienna gasworks was able to adjust the load on natural gas from a seasonal ratio of 1:3.8 to 1:1.6. Speaking of reserves, he said that about half the 30 billion cubic metres estimated to exist was in the dry gas field.

He sounded a note of warning against over optimism by saying that there was not sufficient natural gas to make an outstanding contribution to Austria's energy requirements, although it could make a welcome one.

Visit to the Vienna Gasworks

This proved to be both a pleasant trip and an instructive visit. The works, a few miles outside the centre of Vienna at Leopoldau, is well situated and efficiently laid out. The works was laid down as a coke oven plant in December, 1911, with an output of 250,000 cubic metres per day. Before the second World War this output had been trebled. During the war there was a great deal of damage caused to the works by bombing and shelling but by 1949 this had been largely cleared up.

At the present time the Leopoldau works can produce 550,000 cubic metres of gas daily using coal as a raw material. This output is greatly increased, however, by the addition of natural gas from fields situated only a few miles away.

A mixture of natural gas and producer gas is used for heating the coke ovens. There is a catalytic cracking plant for the natural gas. Some idea of the important contribution made by natural gas to the total gas supplied to Vienna can be gauged by the fact that whereas the maximum capacity of Leopoldau and of Simmering (the older works) is 1,300,000 cubic metres per day from coal and coke, this figure can be approximately doubled by the addition of natural gas.

Storage at Leopoldau is in a dry holder of 300,000 cubic metres capacity and a wet holder of 150,000 cubic metres capacity. Gas is transmitted to the city in two mains operating at a pressure of about 10 lb. per sq. in.

We were told that gas production in 1955 amounted to 445 mill. cubic metres. Gas is used up to 67% by domestic consumers and the balance by trade and industry. 84.7% of all households used gas. It will be seen therefore that gas is a popular fuel in Vienna.

One gained the impression of efficient operation at Leopoldau where considerable skill is being employed in making the best use of the valuable natural gas resources which are so handily placed.

This geographic advantage is in striking contrast to the distances from which coal has to be brought.

Originally Leopoldau was designed to operate on Czecho-Slovakian coal brought in by rail. This supply has virtually ceased and although quantities of coal are imported from other European countries, including Germany, Italy and Poland, the bulk is brought from Canada and the U.S.A. via Trieste.

The proceedings of the closing session, which was on conventional lines, are detailed in the appendices.

The speeches, though, had a special ring of sincerity about them. There is no doubt that the conference was adjudged successful not only for its scientific and technical value but also for the particularly friendly atmosphere which pervaded it. Just before the end Sir Harold Hartley, in a few happily phrased sentences, handed over his high office of President to General Director Holzinger of Austria. And within a few minutes the conference was officially declared closed.

Social Events

In every well organized conference programme, there is provision for social events, and this World Power Conference of 1956 at Vienna was no exception. Vienna is a lovely city possessing probably an unsurpassed collection of palaces and other fine buildings. The Austrian Empire has left an indelible mark on the city's architecture and sculpture, and one cannot journey far without encountering a statue or commemoration tablet of one kind or another bearing the name of the Emperor Franz Joseph I.

The Viennese have the good sense to realize that the Empire tradition, in association with the city's reputation for music and the theatrical art in all its forms, is an immense attraction to tourists. Therefore, it is not really surprising that in a still war-scarred city the magnificent State Opera House has been rebuilt entirely since the war when it was virtually destroyed and that other theatres, and indeed important buildings of all kinds, have been restored in a most lavish manner. The principal shopping centre and the innumerable cafés and restaurants of the better sort, with which the city abounds, are attractively decorated and furnished, and the cuisine of the majority is first class. It is always difficult to make a comparison of prices in different countries, but they appeared to be comparable with those in the West End of London. Unfortunately there is still a shortage of good hotels, but judging by the building and restoration work now in progress this need should soon be met.

The majority of the participants and their ladies attended performances at one or more of the lovely opera houses and theatres. Many visited the Spanish Riding School and some, it is said, even sampled the Vienna night life! Parisian, but less expensive. The various trips into the surrounding countryside were well patronised and many hundreds of us took an evening trip up the Danube at the invitation of the Mayor of Vienna.

H.M. Ambassador gave a cocktail party for the British Commonwealth contingent of whom some 1,200 enjoyed hospitality in an impressive setting. This was quite a delightful affair where one met many home and overseas colleagues under the pleasantest conditions imaginable.

There was considerable competition to receive tickets for the final social event, a Vienna style evening which, owing to bad weather, had to take place in the Konzerthaus instead of in the Schonbrunn Palace as intended. Despite this hurried move, Wiener Abend, as it was called, proved to be a wonderfully presented show comprising orchestral music, opera, choral singing and ballet. The Vienna Symphony Orchestra certainly demonstrated its versatility on this occasion. The singers and dancers were talented, the spectacle superb; we returned to our hotels content.

Altogether it can be said with certainty that we who attended the conference will not easily forget Vienna or its courteous and friendly citizens.

The Conference in Retrospect

It is not easy to make a fair assessment of so large a conference covering so wide a range of subjects, but there can be no doubt that the development of international co-operation in the field of energy which the conference fosters is sufficient reason alone for its existence. Probably the amount of useful technical information gleaned is small in relation to that obtained from more specialized conferences, but it is always interesting and often helpful to know how the other fellow is facing what may be your problems. As every speaker is naturally keen to indicate the technical advancement of his own country a useful stimulus to effort in other countries is provided.

From the gas industry's point of view the significant feature of the Vienna conference was the emphasis on the less orthodox processes of gas production and their associated distribution problems. It is fair to say that natural gas, gas produced from oil in its various forms, and the complete gasification of coal, in that order, were the subjects which most concerned us. Comparatively little time was spent on orthodox gas production methods.

The writing is on the wall and it has been read. It would be foolish to suggest that the traditional methods of gas production either could or should be abandoned, but it would be equally foolish to ignore the latent possibilities of raw materials other than coal for producing gas at a price enabling present loads to be held and future loads to be gained.

I should like to express my gratitude to my colleagues and travelling companions Dr. J. Burns and Mr. A. D. L. Copp for helpful advice on the preparation of these notes, and in particular to the latter for the review entitled 'Some Papers of Interest to British Gas Industry.'

Appendix

SOME PAPERS OF INTEREST TO BRITISH GAS INDUSTRY

Coal Carbonization in Continuous Vertical Retorts in Great Britain. By *Dr. J. Burns*, Chief Engineer, North Thames Gas Board.

The author points out that although examples of continuous vertical retorts are seen widely distributed, only in Great Britain has the vertical retort become a principal means of carbonisation. There has been noteworthy improvement in design of installations in recent years; those at Kensal Green and Bromley are discussed with particular reference to portal frames for carrying the heavy loads such as coal bunkers, to coke grading and cleaning, dust extraction, cool air douche and other amenities, and the production of by-product superheated steam.

Experiments in carrier-gas injection and the carbonisation of weakly coking coals are reported, and the connection between the British open fire and the reactive coke is demonstrated.

Petroleum Products as Raw Materials in the Manufacture of Town Gas in Great Britain. By *J. E. Davis*, Chief Technical Officer, South Eastern Gas Board.

Mr. Davis draws attention to the great changes in the fuel economy of Great Britain, leading to mounting interest in the use of petroleum products as feedstock. He defines the new function of the British gas industry as the seeking of fuel resources which are unacceptable in original form or location to the fuel user, and conveying them and processing them so that they be rendered acceptable. Thus 'out-of-balance' oil refinery fractions form a feedstock as does surplus coke-oven gas and natural gas. The Onia-Gegi and Segas plants for catalytic reforming and gasification are briefly discussed in the light of the carbon-hydrogen ratio of the gases, and useful figures are given in graphical form.

Long Distance Gas Transmission—Economic and Technical Considerations. By *E. M. Edwards* (Member) and *W. T. Hird* (Distribution Engineer) Wales Gas Board.

The paper examines the influences governing the changed conditions which have effected the economics of gas transmission. In Great Britain the Gas Act 1948, which introduced nationalisation, had the profound effect of centralizing production and of encouraging collaboration with other fuel industries. The financial aspects of transmission are examined, as is the effect of gas grids on reducing the demand for that expensive item the gasholders.

The Wales Gas Board has developed two gas grid systems and much detailed information is given both by description and tabulation. Particularly valuable is a table relating technical details to cost of transmission.

A Gas Reforming Plant for Cracked Oil Gas. By *A. H. Jansen*, Chief Engineer, Copenhagen Gasworks.

The author describes the gas supply of Copenhagen where four gasworks are interconnected through medium pressure mains. Advantage has been taken of the building in 1950 of a

(*Continued on page* 48.)

An abstract of a General Report presented at the 5th World Power Conference at Vienna

The Preparation of Gaseous Fuels

By Prof. ADALBERT F. ORLICEK

PRINCIPAL SECRETARY OF THE AUSTRIAN FEDERAL MINISTRY OF TRANSPORT AND NATIONALISED INDUSTRIES, AND OF THE TECHNICAL UNIVERSITY OF VIENNA

To the conventional process of gas production by the carbonization of coal, which is still in many countries the main source of public gas supply, an increasing number of new methods have been added as for instance the complete gasification of coal, particularly of low-grade coal, and the gasification of oil.

These two industries which are closely related to each other have been flourishing continuously in recent years. Both the demand for gas (for the purpose of supplying towns as well as long-distance gas networks) and the demand for coke have been steadily increasing. The principal user of coke is, as before, the iron industry which in spite of the existing tendency to diminish the heat consumption and thus also the coke required per ton of crude iron, needs an ever-increasing quantity of coke as a result of continually increasing production. At the same time, large quantities of coke go for domestic heating. In spite of many endeavours to introduce new processes into the iron industry in addition to the traditional blast-furnace process, whereby the use of blast-furnace coke may be dispensed with, it must be assumed that the demand for such coke will not only continue in the coming years, but that it will further increase. The demand for coke for domestic heating is also likely to show an upward trend. This is true particularly for Great Britain, where efforts are being made to replace coal by solid smokeless fuels (low-temperature coke, semi-coke) in order to lessen the smoke nuisance which prevails in some districts.

Narrow Margin of Profit

In spite of the fact that sales are assured and show a steady upward trend, the European coking industry has to cope with difficulties and in many cases operates with an extremely narrow margin of profit, because coking coal has become very scarce and must frequently be purchased at unfavourable prices from distant collieries or be imported. In view of the fact that coal of a quality suitable for the production of coke may be expected to become even more scarce in the future, the coking industry is endeavouring to bring about a technical rationalization of the carbonization process. In particular, efforts are being made to increase the throughput in order to reduce thus the specific capital expenditure connected with production, as well as to increase the life of coke ovens and to reduce the number of employees. Particular importance must be attached to endeavours to replace the rich gas, which was formerly always and is even now still occasionally used for heating the coke ovens, by lean gas in order to keep the rich gas available for public gas supply. Another very important factor is the utilization of the sensible heat of the coke, whereby the coking process may be rendered considerably more economical. 'Trends in Carbonization Practice and Research in Great Britain With Special Reference to Coke Oven Plant' gives a very detailed survey of all these problems in Great Britain, and it may be assumed that similar problems probably exist also in all other countries.

The shortage of coking coal also makes it necessary to find methods of producing high-grade blast-furnace coke from coals with inferior coking properties. In order to make progress in this field, extensive research work has been started, particularly with a view to determining the quality and properties of blast-furnace coke by suitable methods of test as well as further investigations into the carbonization process, for which it has been necessary to initiate and to carry out research work not only of a technological but also of a broad fundamental nature. It may be assumed that by suitable preparation of the coal to be carbonized and by blending various qualities of coal, it will be possible to utilize for the production of a serviceable blast-furnace coke also such coals as have hitherto been considered unsuitable for coke production or usable to only a very limited degree.

Similar problems are dealt with also in 'Development of Coal Chemistry and Chemical Coal Preparation in Poland,' and it is not without interest that the results reported in the above-mentioned papers agree with one another in many respects, in particular as regards the influence of the structure of coke upon its strength.

Research work must obviously extend also to the behaviour of coke in the blast-furnace, and in this connection investigations of the kinetic of the chemical reaction of solid carbon with gaseous media are of great importance (see also 'How Research on Reaction Kinetics Helps Gasification and Combustion').

The shortage of coals suitable for the production of high-grade blast-furnace coke has also given rise to attempts to produce coke-like products from other qualities of coal with simultaneous production of gas. In this connection particular mention must be made of processes for the low-temperature carbonization of coal which are reported in paper 'Development of Coal Chemistry and Chemical Coal Preparation in Poland,' and by means of which, in addition to producing gas, a semi-coke is obtained which is suitable for many purposes, particularly for use in producers and as fuel for the heating of dwelling houses and central heating installations as well as for certain purposes in the metallurgical and chemical industries.

New Raw Material

These various developments which in many cases are still in a semi-technical stage, make it appear quite probable that in some distant future a large part of metallurgical coke will be produced by new methods and from new raw materials. In this connection a technical development which took place in Great Britain several decades ago is of considerable interest, namely, the carbonization of coal in continuous vertical retorts, which is dealt with in 'Coal Carbonization in Continuous Vertical Retorts in Great Britain.' Whilst, as far as is known, vertical retorts are used on the Continent only in rare cases and then only by small gasworks, large town gas plants of this kind exist in Great Britain, and such plants have been erected even in recent times. Advantages of vertical retorts are the fact that an installation requires little space, and also the avoidance of smoke and dust production. This is achieved to a considerable extent by the fact that the coke is quenched in an enclosed space by means of steam which is utilized in the retort itself for producing water gas, so that the sensible heat of the coke is not lost.

Modern vertical retorts can be adapted to many different working conditions; they are well suited for operating with a great variety of types and grades of coal, and may also be used for low-temperature carbonization. Non-caking coal can also be carbonized. This method is of particular importance for Great Britain because it facilitates the production of a very reactive coke which meets local requirements of fuel for domestic heating.

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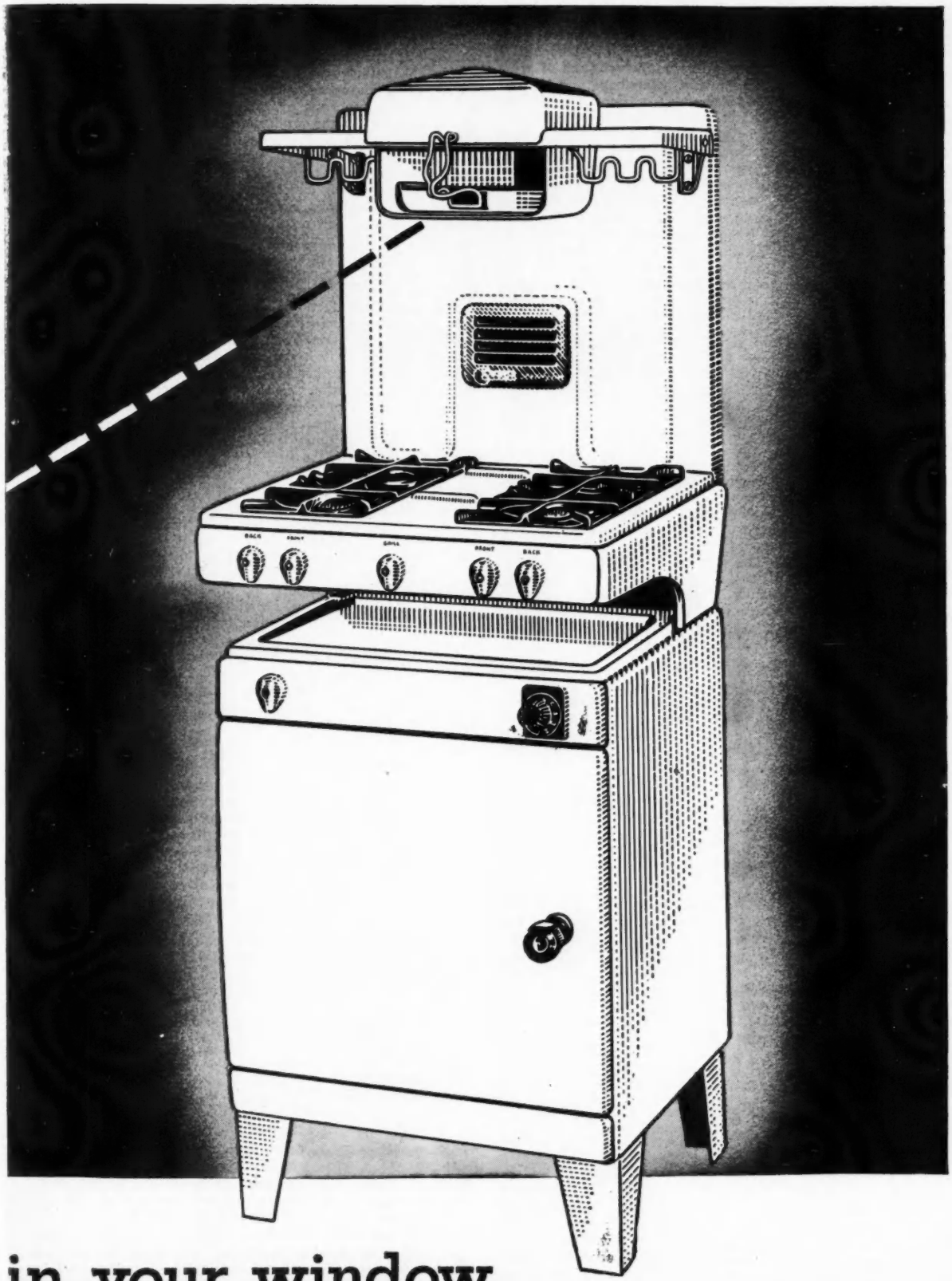

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greatly improved in the course of recent years, whereby a considerable increase in the throughput of the producers has been attained. In this connection the mechanization and automatic operation of the producers has been of great importance. By gasification under pressure the equilibrium composition of producer gas is changed so that gas rich in methane and having a higher calorific value is obtained. Occasionally also the calorific value of the gas is improved by subsequent methanization. The introduction of oxygen as gasification medium has also made it possible to obtain a gas of relatively high calorific value in a continuous process. Frequently, when coke has become scarce, it has been replaced by coal. Particular importance must be attached to the development of new methods for the gasification of coal fines and dust, owing to the fact that the mechanization of coal mining has led to an increased production of fine coal (' Developments in the Gasification of Solid Fuels in Great Britain '). A survey of the state of development of modern generators embodying preliminary low-temperature carbonization is given in paper ' Modern Installation for Complete Coal Gasification.'

Intense pre-heating of air and steam results in high working temperatures in the generator which, in the case of coals with a low ash melting-point, often leads to difficulties. The latter can, however, be avoided by drawing off the ash in liquid form as slag. Information concerning results with new slagging producers of this type is given in paper. ' Progress made in Gas Production on the Basis of Coal from Styria.'

Saving of Energy

Gasification under pressure not only permits very high loading of the producer and supplying a gas of high calorific value but where the gas is needed under pressure it also means a saving of energy because the compression of oxygen requires considerably less work than the compression of the gas. A report concerning the erection of a large Lurgi high pressure gasification plant in Australia which is intended not only for the public gas supply but also to meet the demands of synthesis plants (Fischer-Tropsch), is given in paper ' Pressure Gasification of Brown Coal for Town's Gas Production in Victoria, Australia.'

The development of new gasification processes for coal dust, fine coal and high-ash coals is as already mentioned of particular importance. These methods, which were also discussed in detail at the International Conference on Complete Gasification of Mined Coal, held at Liège in 1954, are reported in paper ' Development in the Gasification of Coal in France.' These new methods aim not only at producing a gas having the approximate quality of synthesis gas or of town gas, but also at obtaining lean gas, which is frequently in urgent demand, because it is used for the heating of coke ovens, whereby it is possible to make rich gas available for other purposes.

Methods for the gasification of coal dust have in common the relatively high working temperatures and high relative velocities between the coal particles and the gas, since in this way high gasification intensities can be attained. This technical development is not possible without a considerable amount of basic research which must begin with the investigation of the mechanism of primary reactions (combustion of carbon with oxygen, Boudouard reaction) and of secondary reactions (water gas reaction, carbon monoxide combustion). Also, clarification must be obtained regarding the influence of physical conditions (temperature, relative velocity, gas pressure particle size and porosity of fuels). This basic research work forms the subject of paper ' How Research on Reaction Kinetics Helps Gasification and Combustion.'

On the basis of the thought that the numerous valuable products contained in coal obtainable by coking or by low-temperature carbonization are lost when coal is burnt under the boiler, attempts have long since been made to combine the generation of power with the process of low-temperature carbonization. In such low-temperature carbonization power plants gas and liquid products are obtained from the fuel as well as a low-temperature coke which is subsequently burnt under the boiler. Paper ' Experience With Combined Steam Generation ' gives an interesting account of Russian projects to utilize waste wood in this manner. There can be no doubt that this project is most attractive because of the relatively high percentage of volatile substances contained in wood.

In recent times oil has been increasingly utilized as raw material for gasification. This is due to changes in the fuel market, but particularly to the ever-increasing shortage of coking coal. In the same measure as coking coal has become scarce in most European countries, attempts have been made to replace coking processes by other methods of producing gas (as for instance for the production of town gas), and this was one of the reasons that coke suitable for the production of water gas and producer gas in the classical type of generator has become more and more scarce. However, not only has the market for solid fuels undergone a change, but also the production of mineral oils has increased greatly as a result of the heavy demand for motor fuels. In addition, new methods of prospecting have made it possible to find large deposits of oil, so that to-day there is no need to fear a shortage of mineral oil within the near future as was the case only a few years ago when intensive research work in the field of the Fischer-Tropsch synthesis was instituted for this reason. In these circumstances mineral oil has become an interesting raw material for gasification. In itself, oil is very well suited for this purpose because its hydrogen content is considerably higher than that of coal. Further advantages of mineral oil gasification plants are: low investment- and working costs and the elimination of the quality problem, because oil gasification plants are able to work with a great variety of mineral oil products, both as regards origin and quality. For reasons of economy one is naturally inclined in the first place to make use of fuel oil residues (Bunker-C oil) as raw material. Developments in the mineral oil market of various countries, particularly the great demand for fuel oil, sometimes make it appear advisable to use distillates—in most cases primary distillates which, owing to their character are unsuitable for use as engine fuel—which offer many advantages for gasification because of their high hydrogen content. The gasification of oil also permits considerable variation as regards the product. This possibility is due to the fact that several chemical reactions are involved in the gasification of oil. The most important of these are; the cracking reaction (the breaking up of a hydrocarbon molecule into smaller fragments and hydrogen), the reaction with oxygen and the reaction with steam. According to the nature of the product to be obtained suitable measures are taken so that certain of these reactions preponderate. The most important types of oil gasification are:

The Production of Synthesis Gas

Here the object is the complete conversion of the hydrocarbons by reaction with oxygen and steam so that the gasification product comprises a mixture of carbon monoxide and hydrogen. This synthesis gas may be utilized for the production of methanol and other alcohols for the Fischer-Tropsch synthesis, and, after the reaction of carbon monoxide to form hydrogen, for the synthesis of ammonia. Paper ' Synthesis Gas from Heavy Oils ' reports on technical plants of this nature.

Unsaturated hydrocarbons are a valuable starting point for the chemical industry and are steadily gaining in importance in connection with the production of solvents, plastics and other organic substances. In these processes the cracking reaction occupies the most prominent position. By-products include hydrogen, heating gas, and occasionally petroleum coke and light liquid hydrocarbons.

Here the object is to obtain a product the combustion characteristics of which correspond as far as possible with those of the gas already being distributed in the existing network. In the course of this process reaction with oxygen and steam takes place simultaneously with the cracking reaction.

Basically all processes for the production of olefins are very similar to one another and there is also a general similarity between the methods for producing town gas and synthesis gas. Mention must be made of the fact that the methods for oil gasification and the corresponding methods for the conversion of methane and other hydrocarbon gases are also quite similar.

In respect of technical realization, however, the various methods differ very considerably. In this connection there is great variety as regards the use of catalysts, the production of the heat necessary for carrying out the process, the recovery of the heat, and other characteristic features of the process.

The cracking of oils and light hydrocarbons can be carried out in the usual gasification plants. Well-known processes include the carburetting of lean gases by various methods, the addition of fuel oil to coking coal, or alternatively the charging of a mixture of coke and fuel oil into the chambers, the injection of mineral oil products into coke ovens and into the gas collecting main and also the gasification of oils in generators of various types. However, in the same measure as gasification of oil has become more widely carried out, special processes have been developed for this purpose. While in the older oil gasification processes the transfer of heat for the endothermic reaction with steam is generally effected with the help of regenerators (heat storage), recourse has also been had in recent times to heat transfer by surfaces. Particularly interesting and probably also efficient methods are those which employ as heat transfer medium a granular solid which is circulated in a suitable manner. Unlike the methods using regenerators which necessitate a periodic alternation in operation, these new methods permit continuous operation. Of special interest is the Höchst process, which is used for cracking hydrocarbons to olefins, particularly to ethylene. In the Lurgi-Ruhrgas process also a fine-grained heat carrier, such as sand, is used. The heating of the heat carrier is brought about in this process by burning off with preheated air the coke deposited on the heat carrier. Only the additional heat necessary for the heating of the heat carrier is supplied by the combustion of fuel oil and the like. In this plant it is possible to process both gaseous and liquid hydrocarbons including Bunker-C oil. The cracking takes place with addition of steam so that it is possible to produce a rich gas corresponding approximately to town gas. Of interest is a new gasification process for the production of synthesis gas developed by Koppers-Totzek, according to which oil or also coal dust is burnt with oxygen in a relatively small reaction chamber and in a very hot flame into which steam is blown peripherally. A cracking process developed by the same firm for the production of ethylene, in which the thermal decomposition of oil is brought about by the heat of hot flue gas, is also of great interest. These processes, like many others which have been developed in recent years, may be employed for the gasification of oil. A survey as well as a description of individual processes and of working results may be found in paper 'Oil Gasification by the Koppers-Totzek Process,' 'Petroleum Products as Raw Materials in the Manufacture of Town Gas in Great Britain.'

The Chemical Conversion of Gaseous Fuels

As long as gas supply was restricted to certain consumers or local networks, the gas could be supplied after a suitable process of purification in the quality in which it was produced, since quality demands could be met by the choice of a suitable method of production. This was all the more so because in general gas was used only for heating purposes and burners could easily be adapted to the properties of the gas. When, however, gas became a raw material of the chemical industry, it became necessary to produce gas of specific chemical composition and insofar as such qualities were not produced originally by gasification, it became necessary to employ additional methods for the chemical conversion of the gas originally produced. To-day the chemical industry often receives its gas from the grid and converts it in suitable plants in such a way as to meet its requirements.

Such methods have been given new objectives through the development of large integrated gas undertakings (see 'Oil Gas and the French Gas Industry'). The supply of gas to large areas is, of course, possible only if the demand for gas of a specific and constant quality is guaranteed both in regard to place and time. This would presuppose supplying the entire network with gas of uniform quality. Originally this was the case, since coke oven gas was predominant for public supply. As endeavours were frequently made to increase the amount of gas obtainable from the quantity of coal used, the coke oven gas was mixed with water gas and producer gas. In this way town gas became usual with a calorific value of approximately 4,000 kcal per N cu. m. (about 440 B.Th.U. per cu.ft.). In order to keep the cost of gas distribution within reasonable limits, it is desirable to maintain the calorific value as high as possible if gas is to be transported over long distances, since in this way the volume of the gas to be transported is reduced. The supply of gas to large areas is to-day still based mainly upon coal distillation-(coke-oven-)gas where no natural gas is available, but these supplies come mostly from the coke ovens of iron and steel combines. In view of the fact that within recent years the demand of existing gas grids had been steadily rising, all possibilities have been exploited to ensure within the framework of an integrated economy of the iron and steel works the greatest possible quantities of coke oven gas was gained by made available mainly by the maximum use of blast-furnace gas for heating the ovens. In many cases, however, attempts have also been made to utilize other sources of gas besides the coking of coal for supply of gas grids. In this connection, important methods for the conversion of gases such as natural gas, tail gases of mineral oil refineries, etc., into a gas having properties generally similar to those of town gas. It is obviously not only important to maintain a similar calorific value, but also to produce a gas resembling town gas in its other combustion characteristics such as density, hydrogen content and content of inerts.

Synthesis Gas from Methane

Apart from these methods, great importance is attached to those whereby it is possible to produce a synthesis gas from methane, i.e., a gas which can serve as starting material for the production of methanol, isobutyl alcohol, or ammonia.

In all these processes the desired reaction products of the decomposition of hydrocarbons are hydrogen and carbon monoxide. Mostly, cracking is carried out with steam in accordance with the reaction given below for methane.

$$CH_4 + H_2O \rightarrow 3\ H_2 + CO$$

It has, however, already been suggested to replace steam entirely or partly by carbon dioxide, i.e., to work on the reaction

$$CH_4 + CO_2 \rightarrow 2\ H_2 + 2\ CO$$

Decomposition could, of course, take place also without the addition of steam (or carbon dioxide) by partial combustion according to the reaction

$$CH_4 + \tfrac{1}{2}\ O_2 \rightarrow 2\ H_2 + CO$$

This reaction is, however, less favourable, because not so much gas is obtained as in the case of the two first-mentioned reactions. The decomposition reaction with steam or carbon dioxide is endothermic and the process must therefore be supplied with heat. This may be done either.

(a) directly, by the addition of oxygen or air to the reaction mixture in which case the exothermic combustion of the hydrocarbon takes place simultaneously with the (endothermic) cracking reaction. It is possible, by regulating the admixed oxygen, to balance the two reactions in such a way that the entire process is just sufficiently exothermic to cover the heat losses of the plant. (When air is used the reaction gas contains nitrogen which must clearly not be harmful. In this connection the production of synthesis gas for ammonia may be recalled). Or

(b) indirectly, by heating the gas by outside heat sources, which may be done either by means of heat exchangers (recuperators, transfer of heat through surfaces) or by regenerators.

As reaction takes place with sufficient speed only at higher etmperatures, the raw gas must be brought to the required high temperature, which may effectively be done by interchange of heat with the gas which has already undergone reaction. As it is of course impossible to transfer the whole of the heat to the raw gas, it is necessary to supply in addition to the heat needed for the reaction further heat whereby the interchange losses occurring in the transfer of heat and the external heat losses may be compensated. In this connection it must be pointed out that, when air is used (instead of oxygen), the heat losses rise owing to the heating of the nitrogen.

By the use of catalysts the necessary reaction temperature is reduced, whereby the heat losses, also the danger of forming undesirable reaction products, such as soot, and the size of the necessary reaction space are considerably lessened.

The composition of the gases produced may be calculated in advance from that of the initial gas in accordance with the laws of thermodynamics, if the reaction temperature is known and if it may be assumed that equilibrium is actually established, which is, in general, likely, to be the case. Such calculations are greatly facilitated by a number of very complete and handy collections of the necessary thermodynamic data, which have been published in recent years. In this connection mention

may be made of "Selected Values of Physical and Thermodynamical Properties of Hydrocarbons and Related Compounds," published by F. D. Rossini and collaborators (Pittsburgh 1953). Depending on the chemical equilibrium, the reaction gas contains in addition to hydrogen and carbon monoxide also water vapour which may be condensed by cooling, and carbon dioxide which, if necessary, must be removed. Such a method for the conversion of refinery gas into town gas is described in paper 'A Gas Reforming Plant for Cracked Oil Gas.' The hydrocarbon gas, which is under pressure, is first heated in admixture with steam to a temperature of 600°C. by heat interchange and then heated to 950°C. by the addition of combustion gases (produced from a subsidiary stream of hydrocarbons with air). At this temperature the gas is led over a catalyst, whereby reaction takes place and the gas, as a result of the endothermic reaction, cools down to a temperature of about 650°C. In order to render reaction as complete as possible (the final gas contains only about 2% methane), the gas mixture is twice more heated to 950°C. and is subsequently decomposed over a catalyst. The cracked gas so obtained, which has a calorific value of about 2,000 kcal per N cu m (220 B.Th.U. per cu.ft.), is mixed with so much hydrocarbon gas that its calorific value corresponds to that of town gas. Owing to the fact that hydrocarbon gases, in particular natural gas but also the tail gases from mineral oil processing, have become available in larger quantities, increasing importance is attached to methods of producing synthesis gas, *i.e.*, a mixture of hydrogen and carbon monoxide, from these gases. The processes run largely parallel and are in some cases even identical with the processes for the production of synthesis gas from oil. With the methods hitherto in use attention has been mainly directed to heat economy, and endeavours have been made to bring about cracking as far as possible by reaction with steam in order to ensure a high hydrogen yield.

A new method, which is described in 'The Use of the Gas Engine in Synthesis Installations for the Simultaneous Production of Synthesis Gas and Power by Means of Partial Burning of Methane and Oxygen,' operates by partial combustion with atmospheric oxygen. By the particular arrangement of this process it is possible to recover part of the energy released during combustion in the form of mechanical work. The new method is characterized by the fact that the partial combustion takes place in an Otto motor. The high degree of development attained in recent years by large gas engines is no doubt an advantage, for this process because it is no longer necessary to develop a new type of engine for it. For the economical working of this method it is a very important fact, that synthesis processes consume a great deal of energy, so that the mechanical work obtained in the operation can be utilized in the process itself. A very elegant solution, which is satisfactory also from the point of view of energy, consists in coupling the gas engine directly to a piston compressor. In this manner it is possible to save not only considerable expense for the electrical installation but also losses due to the double transformation of energy. In the cases of ammonia and methanol synthesis, about 30% to 47% of the power demand can be met by the new method for the production of synthesis gas. In principle, the method can be carried out not only with piston engines but equally well with turbo-engines.

Valuable Starting Material

The chemical transformation of gases, particularly of hydrocarbons, becomes important also in another direction. Since unsaturated hydrocarbons—olefins—constitute a very valuable starting material for the chemical industry (reference was made to this in connection with the gasification of oil), a number of processes have been developed in recent years with a view to producing unsaturated hydrocarbons from saturated ones and, in this way, obtaining valuable raw materials for the production of high-grade motor fuels, synthetic rubber, solvents, synthetic textiles and other products of the chemical industry from gases which could otherwise be used only for heating purposes. These dehydrogenations take place at raised temperatures and are carried out mostly by means of catalysts in the conversion of propane and butane into propylene, butylenes and butadienes, while the dehydrogenation of ethane and other hydrocarbons to ethylene and acetylene is always effected by heat alone.

By the production of acetylene from natural gas and of butadiene from butane, two intermediate products of the chemical industry, which are now being produced in large quantities and which formerly were available only by way of calcium carbide may now be obtained in a new way. Many materials which could formerly be produced only from acetylene are today produced from ethylene. It remains to be seen what effect this development will have on the calcium carbide industry and, consequently, perhaps also upon the electricity supply industry.

This close connection between the gas industry, the chemical industry and electricity supply is noticeable also in other fields.

The Utilization of Blast-furnace Gas

The fact that per ton of crude iron roughly 14.3 mill. B.Th.U. of blast-furnace gas are produced makes it understandable that efforts have been made for a long time to utilize this gas. Although this work is made more difficult by the fact that blast-furnace gas contains large quantities of inerts in addition to 34% of carbon monoxide and 2% of hydrogen, it has nevertheless been possible, particularly by means of suitable integration between the blast-furnaces, steel works, coke ovens and power stations, to utilize the bulk of this gas. In spite of this success which has doubtless been of great importance for the thermo-technical rationalization of the ironworks (compare 'Improvements in the Production Cost that the Iron and Steel Industries can Expect from the Full Utilization of Fuels'), it still happens quite frequently, even though only intermittent, that blast-furnace gas is burnt in a flare. The quantity probably amounts to 15% of the total quantity of blast-furnace gas produced and, in the case of antiquated plants, this figure may even be considerably higher. In view of the high steel production figures, attained throughout the world, considerable quantities of energy are thus lost in this manner. With the introduction of blast-furnaces working with oxygen-enriched blast, the calorific value of blast-furnace gas will be much higher, so that its utilization will presumably be facilitated. This is, however, a development which may yet take many years, and it is therefore of great importance that paper 'Refinement of Blast-Furnace Gas by Hydrocarbon Synthesis' describes a process whereby blast-furnace gas of the usual quality can be utilized in a very profitable manner. As generally known, a gas mixture of carbon monoxide and hydrogen is the starting material for very many syntheses, amongst others for the hydrocarbon synthesis according to Fischer-Tropsch, by which as we know all hydrocarbons from methane to high-melting paraffins can be produced. Blast-furnace gas possesses a property which makes it highly suitable for use as a raw material in the chemical industry, namely, its low content of sulphur. Whilst water gas and other generator gases must be desulphurized for this purpose in very expensive plants, because sulphur compounds destroy the catalysts, no desulphurization is necessary with blast-furnace gas. It is a particularly interesting feature of the new synthesis process that it is not necessary first to convert the blast-furnace gas into a synthesis gas, i.e., a gas in which the ratio of carbon monoxide to hydrogen is about 1:2. In the new method the conversion of carbon monoxide into hydrogen is carried out at the same time as the synthesis over one and the same catalyst. The blast-furnace gas is first compressed to roughly 15 atmospheres, mixed with steam (1 part steam to 3 parts by volume of carbon monoxide), and converted into 90% hydrocarbons in the synthesis oven at a temperature of from 200°C. to 270°C. Since considerable quantities of heat are released in the synthesis oven, a suitable cooling system is necessary. For this purpose the synthesis oven is constructed as a steam boiler, i.e., it is provided with a system of cooling tubes in which water circulates which is evaporated under pressure by the heat of the reaction. The residual gas, which, in addition to the hydrocarbons produced, contains the nitrogen of the blast-furnace gas and the gaseous carbon dioxide produced after leaving the oven first serves to preheat the crude gas and is cooled after heat interchange, so that the higher-boiling products are condensed. It is then finally freed from the lower hydrocarbons in an activated carbon tower. By this process the blast-furnace gas from one ton of pig iron can yield about 180 g. of hydrocarbons, 90% of which are heavier than methane. The product is particularly suited for further chemical processing. It contains not only large quantities of reactive

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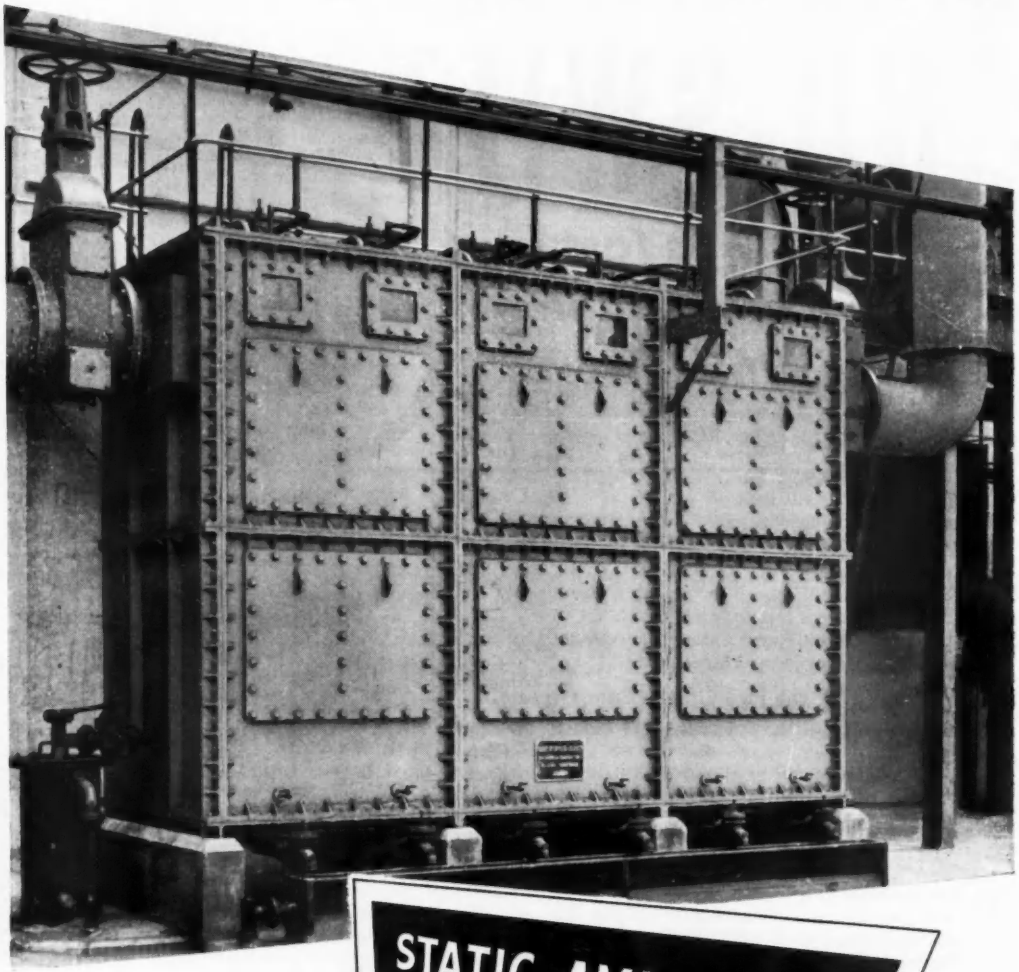

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olefins, but, unlike natural mineral oil, in which there are always large quantities of isoparaffins, it contains a high percentage of straight-chain paraffins, so that it can be further processed both easily and with a wide margin of profit into other valuable products. The new process can doubtless be included easily within the combination frequently found to-day of coke ovens, steel works, ammonia synthesis and power stations, and there is no doubt that it will contribute largely towards a further rationalization of heavy industry.

In the same manner waste gases form other sources containing a high percentage of carbon monoxide, such as those from carbide factories or from phosphorus production, can obviously also be utilized.

Purification of Gas

In the same measure as gas has been distributed over large supply networks increased attention has had to be paid to purification. The impurities which are liable to cause trouble in the supply network are above all moisture and naphthalene, which can give rise to the formation of liquid or solid condensates, certain unsaturated hydrocarbons, from which rubber-like polymerization products may be formed, and sulphur compounds, nitrogen oxides and carbon dioxide, which lead to corrosion in the presence of moisture. If the gas is distributed in a high-pressure network over a large area particular attention must be paid to the removal of harmful constituents, first because disturbances in a long-distance network would be most disagreeable, but also because owing to compression the concentration of impurities by volume rises in proportion to the pressure. However, as was early realized the increased partial pressure of the impurities in the gas under pressure facilitates their removal and also makes it possible to use smaller apparatus. The methods applied at present for the purification of long-distance gas in the Ruhr district and the results obtained thereby are described in paper 'Treatment of Coke-oven Gas under Long-distance Main Pressure in the Ruhr.'

Natural gas frequently occurs in a high state of purity and contains only moisture and varying quantities of higher hydrocarbons. The hydrocarbons are often removed from the gas by cooling and occasionally also by adsorption on activated carbon. So long as the well pressure is considerably higher than that of the pipeline, so that the gas is expanded into the network, it is very simple to cool the crude gas by expansion and thereby to separate the hydrocarbons. The separation of the higher hydrocarbons is, however, in most cases more a question of recovering liquid gas or gasoline than of purification, since condensation of these substances in the pipeline would not be dangerous and they could easily be removed at suitable points of the network. The presence of moisture in natural gas pipelines may, however, give rise to trouble if for climatic reasons lower temperatures are to be expected, or if the gas, on expansion into the pipeline is strongly cooled as a result of the Joule-Thompson effect. In this connection particular attention may be drawn to the fact that the lower hydrocarbons form solid crystalline compounds with water, the melting-point of which is sometimes above 0°C., so that pipelines and valves may 'freeze up' even above 0°C.

Removal of Hydrogen Sulphide

Occasionally natural gas contains considerable quantities of hydrogen sulphide, which must of course be removed from the gas since it not only gives rise to heavy corrosion, but would also be unpleasant owing to the formation of sulphur dioxide on combustion. The removal of sulphur from gas containing particularly large quantities of hydrogen sulphide is reported in 'Improvements in the Production Cost that the Iron and Steel Industry can Expect from the Full Utilization of Fuels' (see also 'The Importance of Chemical Conversions of Gaseous Fuels to the Economic Integration of Gas Supplies Based on Various Types of Primary Gas'). Sometimes natural gas also contains nitrogen and carbon dioxide. These two components are harmful in that they lower the calorific value of the gas and are thus a burden on the pipelines. Nitrogen could be removed from gas only at very great expense and it is not known that attempts in this direction have yet been undertaken. The removal of carbon dioxide is easily possible. Proposals for the removal of carbon dioxide in liquid form from natural gas by expansion of the gas are reported in paper 'Enrichment Without a Compressor of Natural Gas,' consisting of methane and carbon dioxide and obtained from a high-pressure gas well.

Use of Non-caking and Weakly-caking Coals for Gas Making

An exclusive article by

A. R. MYHILL, *F.R.I.C., M.Inst.Gas E.*

THE use of non-caking and weakly caking coals for gas making is one of those problems which are ever old and ever new. In November, 1925, over 30 years ago, a special issue of the 'GAS JOURNAL' appeared, devoted solely to the subject of coke. It was, in fact, known as the 'Coke Competition Number' and it contained a considerable number of theses contributed by competitors for cash prizes, dealing with the manufacture, properties, and utilization of coke. The idea was part of a great national movement, sponsored by gas engineers, plant manufacturers, and fuel technologists, to put coke into its proper place as one of the principal, and one of the most valuable, of our fuels for domestic and industrial uses.

The movement came about in a great measure as the result of the increasing adoption of continuous vertical retorts during the preceding decade, and the production of a type of coke having special characteristics which made it particularly suitable for domestic use. Hitherto, the making of coke, a necessity in the manufacture of town gas, had been looked upon as a necessary evil, and its manufacture and marketing treated as a way of making a virtue of necessity. The considerable amount of research and industrial development which followed resulted in a great improvement in the quality of coke produced, and in the design of appliances to burn it, and led to great increases in demand. As a consequence, the gas industry has now become a true two-fuel industry, and coke, though originally a by-product, shares with gas the status of a main product. On this account it has become essential that the coals selected for carbonization shall be such as will not only give a high gas yield, but will also give a satisfactory quality of coke. The problem of coke production in the present-day gas industry is one of great complexity by reason of many factors, among which the following are notable: (a) Continually increasing shortage of caking coals; (b) developments of methods of gas manufacture which do not produce coke; (c) the development of oil refineries and their establishment on a very large scale in Great Britain; and (d) the impact of the Clean Air Bill.

Lack of a National Fuel Policy

Unfortunately there does not appear to be any nationally agreed fuel policy in this country, and opinions are widely divided, influenced by vested interests and political exigencies. The gas industry is faced with making a decision as to whether it shall continue to function as a two-fuel industry, or whether it shall make gas alone.

Some authorities believe, or advocate, that gas should be made entirely from oil, or by the total gasification of coal. A consideration of the recommendations of the Beaver Committee and their implementations in the Clean Air Bill, however, makes it certain that the production of solid smokeless fuel must continue. Indeed, the gas industry has already pledged itself to produce the necessary amounts of such fuel for future requirements, so that notwithstanding any further

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developments in the adoption of complete gasification, carbonization will have to continue.

How to meet the shortage of carbonization coals therefore becomes a matter of prime importance. In this connection it is well to remember that, while it is true that an insufficient amount of caking coal is being raised from the mines, much of the shortage of suitable material for gasworks purposes is brought about by the extensive use of gas coals for wrong purposes, as, for example, in domestic grates, under boilers, and in furnaces, where other coal types would serve equally well, and generally better. There should be a restriction, if necessary by legislation, of the use of caking coals to the gas and coking industries. In addition, the use of as high a proportion as possible of non-caking coals for making gas and coke should be encouraged. In general, this latter object should be fulfilled by carbonizing selected blends of material.

Coal Characteristics in Relation to Gas and Coke Manufacture

It is now customary to clarify all coals whether or not used normally for gas-making, into nine main groups, 100-900, with certain sub-groupings. The system is used by the National Coal Board, and, with minor modifications, was that published in 1946 by the Fuel Research Division of the Department of Scientific and Industrial Research.[1, 2]

The classification is based on the volatile matter content, expressed on the dry, ash-free basis, and the caking properties, as determined by the Gray-King method. These are defined as coals with less than 7.5% of ash. If the coal has a higher ash content than 7.5%, it is floated at such a specific gravity as will give the maximum yield of coal with not more than 7.5% of ash.

In general, the lower the classification number, the lower is the volatile matter content. Factors determining the suitability of a coal for gas-making relate to the group to which the coal belongs. Within a given group, size grading and ash content are also important considerations. First choice gas coals are drawn from the 400-500 groups, and second choice from the 500-702 groups.

Coals of the 702 to 902 groups, although of the weakly caking or non-caking types, and therefore not, in themselves, suitable for carbonization, can, under special conditions, be used in blends with other coals for making coke in gas retorts and coke ovens.

Use of Non-caking or Weakly-caking Coals for the Production of Coke

Methods which have been suggested and adopted for the production of good coke from non-caking coals comprise (a) blending with highly caking coals, (b) additions of certain substances to the non-caking coal to induce coking by supplying an agglutinant. These methods may be used either separately or in conjunction.

The blending of caking and non-caking coals can be considered from three angles: (a) Coke-oven practice; (b) gasworks practice in static retorts or chambers; and (c) gasworks practice in continuous vertical retorts.

The advantages which might be expected to accrue include the following:—

(i) Extension of the range of coals available.

(ii) Prevention of excessive expansion during coking, and avoidance of sticking troubles or damage to refractories. This relates mainly to coke oven practice and to highly-swelling coals.

(iii) Improvement in heat penetration of the charge by the elimination or reduction of the poorly-conducting plastic layer, allowing of increased carbonizing rates.

(iv) Improvement in the working of continuous vertical retorts in the case of certain coals which, by reason of their highly swelling nature, may, when used alone, lead to erratic coal travel through the retorts.

(v) Control over coke characteristics by variations in the blends of coal used.

Disadvantages of blending may include:—

(i) Necessity of crushing the coal before blending. For all static carbonizing systems, it is necessary to use coal which has been crushed to pass through a ¼ in. mesh, in order to obtain intimate mixtures. Plant for ensuring good mixing in pre-determined proportions, grinding machinery, hoppers, belts, etc., must be provided. This is normal in coke oven practice, but would generally have to be specially supplied for gasworks.

(ii) To justify the erection of special plant for the above, a reasonable expectation of certainty of delivery of the required coals would be essential.

(iii) For continuous vertical retorts, blends containing fines cannot, in general, be successfully used. The known disadvantages of poor coal travel with fine coal are noticeable even when carbonizing one type of coal, and any desired improvement by blending is unlikely to be realized if fines are present in any considerable quantity, on account of segregation brought about by a moving charge.

Effects of Blending

Blending may have certain effects on rate of gas production and on the gas yield per ton of coal. By replacing part of the amount of caking coal by coal of a non-caking type, it is often found that, with decrease in caking power, there is usually an increase in natural moisture content of the coal, and in the oxygen content of the coal substance. This will result in a lower gas yield per ton, and the production of gas of lower calorific value, higher proportion of CO_2 and increased specific gravity. The improvement in heat penetration referred to above may, however, offset these effects in both static and continuous carbonization, and, in the latter case, generally improves the rate of gas production by allowing smoother coal travel. The reactivity of the coke also generally increases with decrease in the caking power of the blend.

It has been shown that 50/50 blends of types 402 (strongly caking) and 902 (non-caking) can be carbonized in horizontal retorts to produce a coke equally satisfactory in properties to that from 402 alone, but it is particularly important to have a well crushed and intimately mixed blend.

A method of overcoming some of the disadvantages associated with the direct use of fine coal blends which has achieved a measure of success, is the process of making briquettes from mixtures of caking and non-caking coals, or even from caking coals and coke breeze, and afterwards carbonizing in continuous vertical retorts.

The briquettes are made coherent by the incorporation of a small quantity of a binding agent such as pitch, and are moulded under pressure into 'ovoid' shapes weighing about 2 oz. each. The process has been practised for over 30 years but, for various reasons, has not found very wide application. The scheme is, however, definitely practicable, and cases may well arise in modern circumstances where it could be used with advantage.[3, 4, 5, 6, 7, 8, 9].

Suitability of Coals and Blending Agents

Despite the fact that coal blending has been carried out for many years, particularly in the coke-oven industry, it still remains largely an empirical art. A considerable amount of research has been done on the fundamental principles underlying coking phenomena, and this has removed some of the uncertainties of blending practice, but there is still an urgent necessity for more investigation into the subject. Methods of trial and error must still be resorted to, and, while such methods are useful in that they provide direct evidence of suitability or otherwise of the blends used in a particular type of plant, much of the value of the work is lost by lack of knowledge of the causes operating to give the results. Moreover, the time necessarily taken in carrying out full-scale tests on different mixtures greatly limits the rate at which information can be obtained.[8, 9, 10].

Further developments of laboratory methods for testing the suitability of blend constituents would be invaluable in the saving of considerable time and expense which is involved in making large-scale trials.

It is well known that caking coals contain agglutinating constituents which are probably aromatic compounds of molecular weight 350-400, and which are capable of extraction by suitable solvents. Many highly caking coals are believed to contain considerably greater proportions of agglutinants than are necessary for the production of good coke, and, in fact, have undesirable features on account of their too-high swelling nature.[9, 10].

Two Theories on Coke Formation

Two theories have been propounded regarding the formation of coke from coal: (a) Part of the coal provides a fusible binder for the remainder; (b) complete 'fusion' of the whole of the coal substance must take place prior to intumescence.

The first theory is the most commonly accepted one, although there is considerable support for the second.

If the first theory is correct, it is reasonable to suppose that any combination of caking and non-caking coals would prove suitable as a blend, provided the right proportions were used. The second theory does not allow of this supposition, but rather indicates that a certain compatibility must exist between the coals before complete fusion together is possible.

The question therefore arises—are there any particular types of coal which are unsuitable for blending with a given coal?

J. G. King[8] has shown the probability that this is not so. Any special suitability of the non-caking or low-caking coal of the high-volatile class such as would be used for carbonization is not an important consideration. Its main function is simply that of a diluent which absorbs the fusible components of the caking coal. A coal may be non-caking because of a deficiency in agglutinants, the latter being insufficient to completely impregnate all the infusible constituents or the coke produced from them.[8, 11]

Different caking coals may be said to have varying degrees of 'fluidity,' which depends on the proportion and, possibly, the chemical composition of the agglutinant. Coals with a high degree of fluidity are productive of the strongest coke when used as components of a blend with non-caking varieties.

A. R. Powell[10] has described a modified 'plastometer' for determining the fluidity of a coal. Many determinations have been made in America by this apparatus, and have been found of use in assessing the behaviour of coals used mainly in the coke oven industry. There appears no reason why such a line of investigation should not be applied to coals intended for gas making.

American Experiments

Some American investigators have experimented with the addition of small quantities of a highly fluid coal to blends of two other coals of relatively low fusibility to form a three-component blend which will produce a good coke from coals which do not, when used separately, produce satisfactory cokes.

Where the caking coal in a blend is highly fusible, fine crushing or very intimate mixing becomes less important, and on this account, such coals can often be successfully used, in nut form, in continuous vertical retorts. It is nevertheless true in general that static carbonizing methods are likely to respond more favourably to blending practice than continuous methods.

Methods have been suggested for the conversion of non-caking coals into caking coals by the addition of materials which are either agglutinants in themselves, or are such as would lower the viscosity of the molten coal during carbonization and, by increasing the fluidity of the plastic coal, would cause penetration into, and absorption by, the particles of the non-caking coal or its coke.[11]

Reference to patent and other literature shows that many substances have been proposed and used for this purpose. Among such substances may be mentioned pitch, tar, high-boiling tar oils, paraffin wax, petroleum products and waste vegetable products. Improvements in coke properties have been reported in American work by the use of 1-4% of coal-tar pitch as an agent for increasing coal fluidity.

Suggestions have been made for the incorporation of extracts of coking constituents derived from highly caking coals by solution in a suitable medium. In this connection it has been stated by some experimenters that the direct addition of the pyridine-soluble component derived from a caking coal to the non-caking residue does not always restore the caking properties to the coal.

If, however, the same component is dissolved in a solvent, its addition will restore the caking properties.[11]

Conclusions: Plan of Future Investigations

Consideration of the above indicates the need for continuing investigations on the laboratory scale, on the pilot plant scale, and on the full scale plant. In view of the lack of fundamental knowledge on the phenomena of coking, the desirability of carrying out fundamental research, and of closely following up the work of investigators in this field is indicated, both as an immediate and a long-term policy. In the meantime it is suggested that each area board would be well advised to conduct a detailed survey, relating to its own particular geographical situation and local circumstances, along the following lines:

(a) Enquiries as to costs and facilities for obtaining regular deliveries of non-caking high volatile coals,

(b) proximate analyses and laboratory tests on the above, to determine their group numbers, size grading, and other characteristics,

(c) investigations into methods of determining 'fluidity' of those highly caking coals currently in use in the area. (Enquiries as to the possibilities of the Gieseler Plastometer[10] are suggested.) Having established the practicability of the method, each of these coals should be appropriately classified,

(d) 'Cronite' retort tests[12] on coals belonging to groups 700-902, and on blends of these coals with caking coals used in the area which lie within groups 400-500.

These small scale tests could be carried out in a few hours each, at comparatively low cost, and could be taken as indicative of the particular coals likely to be treated successfully on the works scale, and might be useful in ruling out certain unsuitable coals, thereby saving time and cost of testing these latter on the large scale.

(e) Having thus decided on blends likely to be successful, tests might be carried out on the works scale as follows:

(i) Crushed mixtures in horizontal retorts or intermittent verticals.

(ii) Continuous vertical retort tests, which would be direct carbonization, in cases where the coals can be obtained in clean nut form, or carbonization of briquetted mixtures of fine coals with a small proportion of pitch or other binder.

(f) Tests on the practicability of adding agglutinants to non-caking coals and weakly-caking blends.

Since this would probably involve the addition of a more or less viscous liquid to the crushed coal, the contamination of hoppers, chutes, conveyors, etc., with sticky deposits might be envisaged. On this account it is suggested that the incorporation of the agglutinant into the mixture should be carried out by making briquettes, and the blend carbonized in this form, in either static or continuous retorts.

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World Power Conference—

Continued from p. 36.

large oil cracking plant (the Maersk Refinery) and an agreement was made to buy large quantities of high calorific value gas. It was decided not to dilute with air, but to reform the gas, and this has been reformed catalytically with some novel features of design. Gas is dried before distribution in a T.E.G. plant.

The Italian Long Distance Natural Gas Transmission System. By *Dr. R. Girotte*, Milan.

This is an extremely interesting paper as it deals with an industrial revolution caused by the discovery of the natural gas resources of the Po valley, near the manufacturing cities of Northern Italy. Utilization has been conceived on entirely noval lines, particularly due to a chronic shortage of electricity; so the gas has been diverted mostly to non-domestic usage, after a market survey. There is a very good description of the distribution system with good argument on technical details; conditions in Italy do not resemble those of the U.S.A. and new thinking had to be applied to problems.

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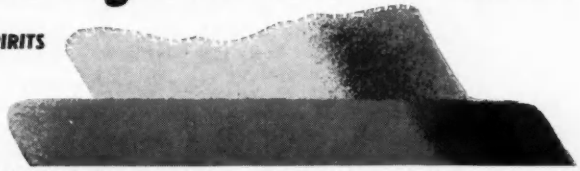

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Long Distance Gas Transmission in France. By *G. Combet* Director General, and *P. Courtet*, Assistant Director of Production and Long Distance Transmission, Gaz de France.

The authors give a full account of the progress of gas transmission in France in the past 30 years, leading to the present high pressure pipelines the ultimate economies of which are discussed and illustrated by useful graphs. The prospect of a large source of cheap natural gas is very real, and further long pipelines, together with the increased use of underground storage will develop.

Liquid Gas . . . *an investigation*

By JOHN D. CRECCA, Jnr.

PART IV.—*continued*

The piping arrangement will permit filling from either side of the ship to either the forward group of tanks or the after group or to both simultaneously. Also the pump on one side can discharge through the side connection on the opposite side.

The piping from the methane tanks was not run fore and aft below decks in order to avoid the serious objections resulting thereby. The practicability of designing a satisfactory watertight joint, where the pipe passes through the bulkhead, without seriously compromising the effectiveness of the insulation, is questionable. Resort would have to be made to the use of specially designed materials having insulating value, for the stuffing tube and nut. However, the principal objection to running the methane piping below decks is that in case of damage to any single line going through a methane tank room the resulting danger of fire and explosion would be extended into adjacent tank rooms. It is believed to be imperative for safety that each methane tank be isolated from the others as much as practicable.

To realize this isolation as far as possible, the filling and suction line from each tank is run separately up to and along the upper (weather) deck to the 6 in. manifold in the methane pump room. A common suction and filling main is avoided. A cut-out valve is provided in each filling and suction pipe after it passes through the weather deck. This arrangement will require special protection from physical damage. However, the serious problem is the ability to effect the high suction lift and head from each tank to the pump. The maximum suction head for the worst case, when the tank is nearly empty, is a lift of 31 ft. and friction head of about 7 ft.

Theoretically, the liquid methane with a 26 lb. per cu.ft. density should lift about 80 ft. The question, however, is whether this liquid will tend to vaporize when put under suction. To avoid this, pressure from the inert gas system should be used when pumping starts to force the liquid to the pump. If this suction lift is not practical, and the piping must be run below the methane tanks to effect a positive head feeding the liquid to the pump, the solution would be:

(a) To accept the hazard of running the piping through the methane tank rooms.

(b) Provide a separate pipe tunnel high enough to permit access for inspection. This may mean loss of some double bottom cargo oil space as, obviously, it would not be desirable to locate the trunk high enough so as to lose methane storage space.

With the use of a pipe tunnel, the methane pump room would have to be located in the deep tanks forward or use the forward cargo oil pump room and confine all cargo oil pumping to the after cargo oil pump room. This appears to be acceptable since the cargo oil capacity has been reduced by over 50%.

The material of the pump, valves and piping is '18-8' type stainless steel. The pump, valves and piping should be insulated with at least 6 in. of 'Styrofoam.' The 'Styrofoam' around the piping and valves in the weather should be finished off with the ¼ in. hard fibreglass cloth to keep out moisture and furnish physical protection for the insulation. The 6 in. insulation thickness should apply to all this system from the methane pump room to the first valve in 4 in. filling and suction line just above the upper deck. From this valve down to the tank, this line should be insulated with 12 in. thick 'Styrofoam.' The 4 in. pipe should be connected to the tank by an oversize flange with a one or two inch thick gasket of 'Styrofoam' or balsa between the flange face and the tank. The portion of the 4 in. line extending into the tank will be connected to the oversize flange with a flange bolting to an inner row of holes, on the oversize flange, from that connecting the oversize flange to the tank. The bolt holes and washers of the flange bolts will be insulated. Thus, there will be avoided a continuous metallic path from the methane liquid to the steel structure when methane is not flowing. Where the 4 in. line passes through the upper deck, which is a weather deck, a metal collar should be fitted extending high enough to form a kick piece to protect the 12 in. insulation around the pipe and to keep out water from the opening. The suction and discharge piping to the bottom of the tank should branch into at least four or more outlets to distribute the cold liquid uniformly and avoid eccentric thermal stresses.

Suitable grounding of pumps and piping will be necessary in view of the electrostatic properties of most liquid petroleum products when flowing in pipes, particularly because of the frequent insulated joints referred to.

Inert Gas Generator System

It is believed that it is necessary to provide inert gas to the void spaces between the new methane storage tanks and the sides of the rooms in which they are located. This will provide fire protection in case of leakage of methane into the void space. Besides, it is believed that it is imperative to provide an inert gas as a continuous blanket over the liquid methane in the tanks and to use inert gas to purge the methane pipe lines of liquid methane or methane gas.

A 50% concentration of inert gas will require 105,000 cu.ft. for the void areas around the tank and about 80,000 cu.ft. for the tanks themselves. An inert gas analyzer may be used to check these spaces. Any necessary inspection may be done by personnel wearing respirators. Thus, there will only be a leakage loss replacement need for the void spaces. However, the gas in the cargo tanks must be replaced on each round trip. To accomplish this, four 1,200 cu.ft. per hour generators are needed. A bank of storage bottles are provided to hold 87,000 cu.ft. Thus, while the ship is at sea, the inert gas that is needed to replace the cargo as it is unloaded may be generated. In this manner the ship will be independent of any shore source. This will reduce limitations on ports of call.

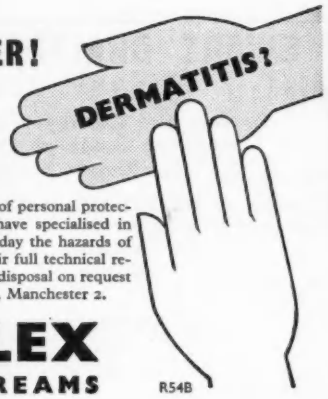
There are two sytems of piping proposed, one for the voids around the methane tanks and one for the methane tanks themselves. Each system consists of a ½ in. extra strong black pipe main delivering 300 lb. per sq. in. inert gas from the generators to the accumulators and a distribution panel, and from the distribution panel, the inert gas is delivered through a reducing valve (5 lb. per sq. in.) and a relief valve and a 1¼ in. standard pipe main to the spaces served. The composition of the generated inert gas is 86% nitrogen, 12% carbon dioxide and 2% oxygen.

The carriage of other petroleum products was contemplated in the original plan of conversion. Since the demands for the methane may be seasonable, it is essential that the vessel be capable of carrying other cargo. Therefore, the wing cargo oil tanks are retained as such, because the size and shape of these tanks and the extent of interior framing would result in rather small net volume of any tanks that could be installed therein for methane.

As noted before, the installation of the inner bottom permitted utilization of the space under it for cargo oil, thus reducing the amount of cargo oil space lost in the installation of the methane tanks.

Particular pressure on our space has made it necessary to publish only a short instalment of 'Liquid Gas' this week. This will be rectified next week.

PROTECTION IS THE ANSWER!



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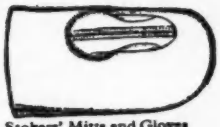
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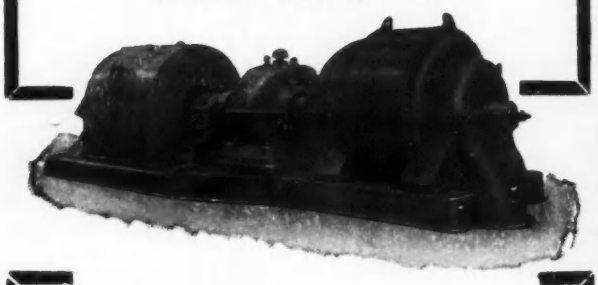

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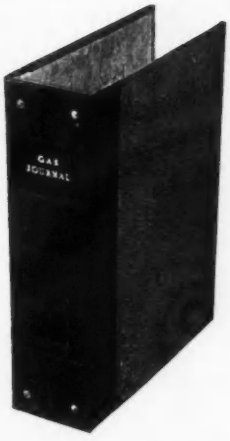

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Classified Advertisements: All small classified advertisements are charged at 2/- per line (approx. 7 words)—minimum charge 10/-. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received 14 days prior to publication if proofs are required. Type area of inside pages 10 in. deep × 7 in. wide; block screen 120.

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APPLICATIONS are invited for the following appointments in the Commercial Manager's Department at Board Headquarters in Edinburgh.

PURCHASING OFFICER: Salary Scale £1,675 per annum—£1,925 per annum.

Duties will include preparation of appropriate specifications, negotiation of contracts, and co-ordination of purchases throughout the Area of the Board.

Applicants should have comprehensive experience of purchasing appliances, fittings and other materials such as are used in the gas industry.

COAL AND BY-PRODUCTS OFFICER: Salary Scale £1,525 per annum—£1,725 per annum.

The officer will be responsible for all matters relating to coal and by-products (excluding coke and breeze). His principal duty will be the allocation of coal throughout the Board's undertakings.

Applicants must hold an appropriate technical qualification.

PRESS AND PUBLIC RELATIONS OFFICER: Salary Scale £1,375 per annum—£1,575 per annum.

Applicants must be experienced in all phases of press and public relations work, and must be able to prepare articles suitable for publication. Experience in producing a house magazine would be of advantage.

ADVERTISING AND PUBLICITY OFFICER (Sales): Salary Scale £1,105 per annum—£1,265 per annum.

Applicants should have experience in all branches of publicity, have a knowledge of production work and be able to prepare layouts, copy and suggestions for display. Agency experience would be desirable.

Initial placing within the above salary scales will be according to qualifications and experience.

The positions are pensionable, and the successful applicants will be required to pass a medical examination.

Applications stating age, and giving particulars of education, training, experience and qualifications, together with the names of two referees, should be addressed to the undersigned to arrive not later than fourteen days after the appearance of this advertisement.

A. T. HERD,
Secretary.

26, Drumsheugh Gardens,
Edinburgh, 3.

SCOTTISH GAS BOARD

GLASGOW DIVISION
GENERAL MANAGER

APPLICATIONS are invited for the position of GENERAL MANAGER of the Glasgow Division of the Scottish Gas Board. The commencing salary will be not less than £3,500 per annum.

Applicants must have wide administrative experience and possess sound knowledge of all aspects of management in the gas industry.

The position is pensionable, and the successful applicant will be required to pass a medical examination.

Applications stating age, education, qualifications, present appointment and previous experience, together with the names of two referees, should be sent to the undersigned within twenty-one days of the date of this notice.

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PLANT MANAGER required to take control of chemical processes. The candidate should have a degree in Chemistry, Engineering or Chemical Engineering and wide experience in the Chemical, Petroleum Chemical or Tar Industries. The position offers possibilities of advancement and a high salary will be paid to the man who proves a success. Applications should be sent to: The General Manager, Laporte Chemicals, Ltd., Baronet Works, Warrington.

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APPLICATIONS are invited from suitably qualified persons for the above position.

Applicants should have a sound knowledge of the operation of automatic C.W.G. Plant, ancillary work plant, and will be expected to carry out routine chemical testing on the works.

The duties of the post include the supervision of the Crindau Works which handles 4 mill. cu.ft. of gas per day (including 2 mill. cu.ft. of C.W.G.) also the maintenance of district holder and compressing stations.

The commencing salary will be within Grade A.P.T. 8 (£710/£790) Provincial "A" of the National Salary Scales for Gas Staffs.

The post is pensionable, and the successful applicant will be required to pass a medical examination. A flat will be available in the near future at a reasonable rental (if required).

Applications stating age, qualifications and experience, together with the names of two referees to be submitted to the undersigned within fourteen days of the appearance of this advertisement.

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The salary will be within A.P.T. Grade 10 (£820-£920 per annum) of the National Salary Scales for Gas Staffs.

The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications stating age, details of training, qualifications and experience, together with the names of two referees, should be addressed to Mr. C. F. W. Rendle, Divisional General Manager, West Midlands Gas Board, Newtown Road, Worcester, to reach him not later than July 9, 1956.

J. C. INGRAM,
Secretary to the Board.

NORTH WESTERN GAS BOARD

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APPLICATIONS are invited for the above pensionable appointment at a salary within Grade A.P.T. 10 (£820/£920 p.a.).

Applicants should have had sound experience in a Production Engineer's Department and be familiar with all types of carbonizing plant and the production of gas, coke and other products. It is very desirable that applicants should possess the qualification of the Institute of Cost and Works Accountants.

Applications should be made on the official form obtainable by writing to the Chief Personnel Officer, N.W.G.B., Liverpool Group, Radiant House, Bold Street, Liverpool, 1, and should be returned to him within 14 days.

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This is a pensionable position and successful candidate would have the opportunity of further advancement.

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Applications (three copies) stating date of birth, qualifications and experience should reach the Registrar, the University, Leeds, 2 (from whom further particulars may be obtained), not later than July 20, 1956.

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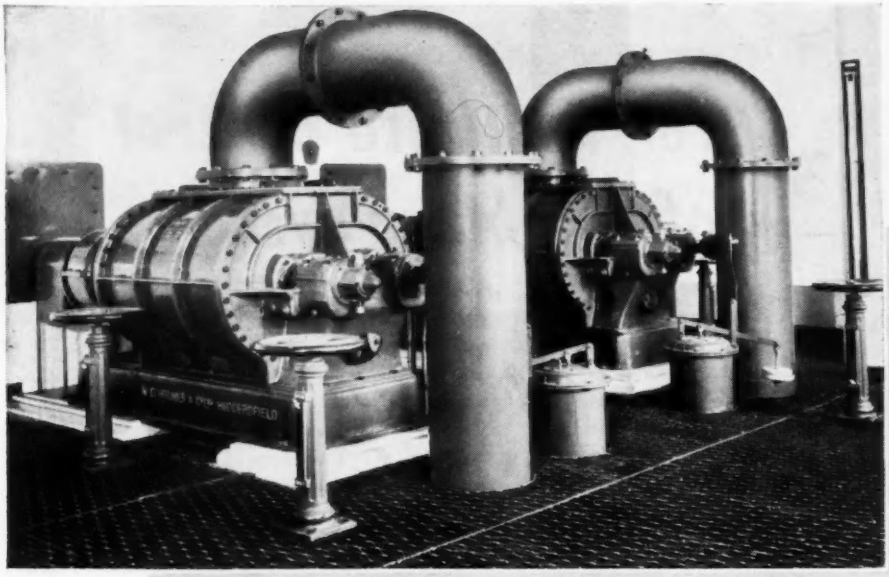

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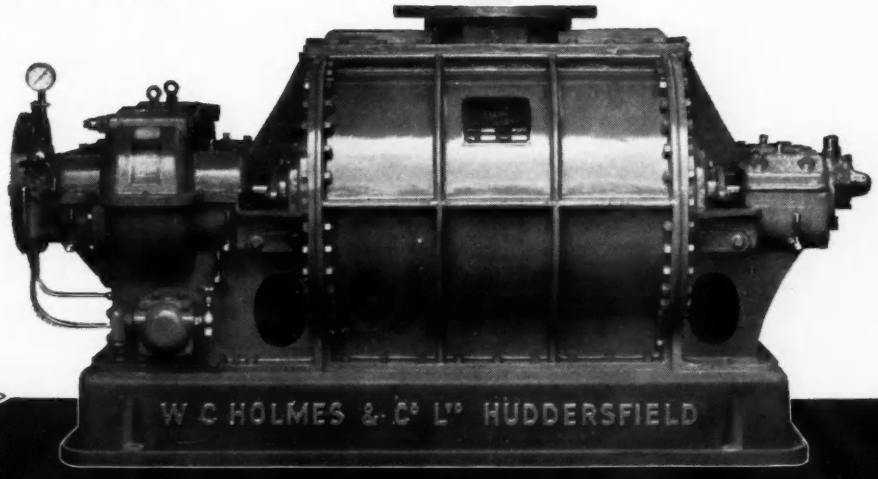

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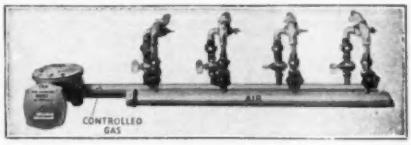

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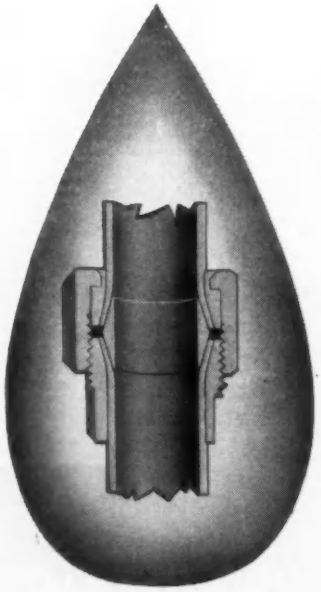

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